I. 11: 14/6
Index Table
TECHNOLOGY AND SCIENCE
DETROIT PUBLIC LIBRARY

Vol. 14, No. 6
March 31, 1989

Energy Research Abstracts

Abstracts 10602-12502

Office of Scientific & Technical Information
UNITED STATES DEPARTMENT OF ENERGY

International Copyright,© U.S. Department of Energy, 1989, under the provisions of the Universal Copyright Convention.
United States copyright is not asserted under the United States Copyright Law, Title 17, United States Code.

Vol. 14, No. 6
ISSN: 0160-3604
CODEN: ERABD
March 31, 1989

ENERGY RESEARCH ABSTRACTS

ABOUT THE OFFICE OF SCIENTIFIC AND TECHNICAL INFORMATION

The Department of Energy's Scientific and Technical Information Program (STIP) is carried out at many levels within the Department and by its contractor organizations. The Office of Scientific and Technical Information (OSTI) in Oak Ridge, Tennessee, provides direction and leadership for STIP and serves as DOE's national center for scientific and technical information management and dissemination. Both DOE-originated information and worldwide literature regarding advances in subjects of interest to DOE researchers are collected, processed, and disseminated through the Energy Data Information System (EDIS) maintained by OSTI. The major data bases in this system are available within the United States through commercial on-line systems and to those outside the United States through formal governmental exchange agreements. The current-year records for the major data bases plus a number of specialized data bases are available to DOE offices and contractors through OSTI's Integrated Technical Information System (ITIS). To manage DOE's information resources effectively, DOE's Scientific and Technical Information Program is one of continual development and evaluation of new information products, systems, and technologies.

Detroit Public Library

APR 5 1989

Depository Document

ABOUT *ENERGY RESEARCH ABSTRACTS*

Energy Research Abstracts (ERA) provides abstracting and indexing coverage of all scientific and technical reports, journal articles, conference papers and proceedings, books, patents, theses, and monographs originated by the U. S. Department of Energy, its laboratories, energy centers and contractors. *ERA* also covers other energy information prepared *in report form* by federal and state government organizations, foreign governments, and domestic and foreign universities and research organizations. Foreign information is obtained through the International Energy Agency's 13-nation Energy Technology Data Exchange, the International Atomic Energy Agency's International Nuclear Information System, or nation-to-nation agreements. **Please note that *ERA* coverage of non-report literature is limited to that generated by Department of Energy activity.**

ERA is comprehensive in its subject scope, encompassing DOE's research, development, demonstration, and technological programs resulting from its broad charter for energy sources, supplies, safety, environmental impacts, and regulation.

Information in *ERA* is available for on-line searching as part of the Energy Data Base. The current-year records are available on the Integrated Technical Information System (ITIS). The entire data base is available through commercial on-line vendors.

DOE and DOE contractors who have OSTI deposit accounts can obtain *ERA* from the Office of Scientific and Technical Information, P. O. Box 62, Oak Ridge, TN 37831, Attention: Information Services. For further information, call (615)576-8401, FTS 626-8401. *ERA* is also available at authorized Depository Libraries.

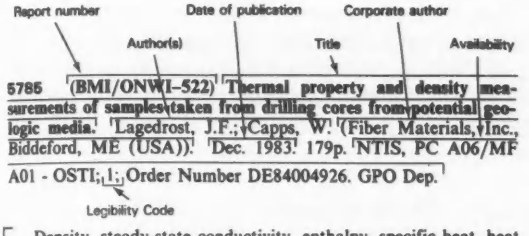
ERA is available to the public on a subscription basis from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402. The subscription rate for 24 semimonthly issues is $184.00 for domestic subscribers and $230.00 for foreign subscribers. A single issue costs $27.00, domestic, or $33.75, foreign. Cumulative indexes are available from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402.

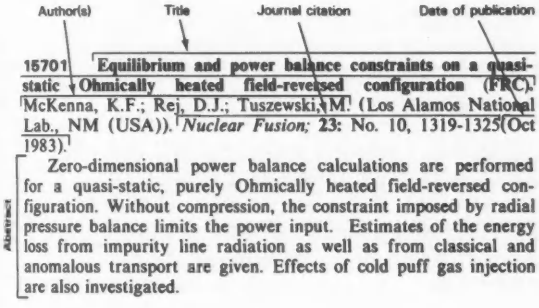
Managing Editor, Audrey B. Smith
Technical Editor, M. Catherine Grissom

Office of Scientific and Technical Information
United States Department of Energy, P. O. Box 62, Oak Ridge, TN 37831

ABSTRACTS IN *ENERGY RESEARCH ABSTRACTS*

The principal elements of abstract entries for a typical research and development report and a typical technical journal article are illustrated below.


Report number
Date of publication
Corporate author
Author(s)
Title
Availability
5785 (BMI/ONWI-522) Thermal property and density measurements of samples taken from drilling cores from potential geologic media. Lagedrost, J.F.; Capps, W. (Fiber Materials, Inc., Biddeford, ME (USA)). Dec. 1983. 179p. NTIS, PC A06/MF A01 - OSTI; 1; Order Number DE84004926. GPO Dep.
Legibility Code
Abstract
Density, steady-state conductivity, enthalpy, specific heat, heat capacity, thermal diffusivity and linear thermal expansion were measured on 59 materials from core drill samples of several geologic media, including rock salt, basalt, and other associated rocks from 7 potential sites for nuclear waste isolation. The measurements were conducted from or near to room temperature up to 500°C, or to lower temperatures if limited by specimen cracking or fracturing. Ample documentation establishes the reliability of the property measurement methods and the accuracy of the results.


Author(s)
Title
Journal citation
Date of publication
15701 Equilibrium and power balance constraints on a quasi-static Ohmically heated field-reversed configuration (FRC). McKenna, K.F.; Rej, D.J.; Tuszewski, M. (Los Alamos National Lab., NM (USA)). Nuclear Fusion; 23: No. 10, 1319-1325 (Oct 1983).
Abstract
Zero-dimensional power balance calculations are performed for a quasi-static, purely Ohmically heated field-reversed configuration. Without compression, the constraint imposed by radial pressure balance limits the power input. Estimates of the energy loss from impurity line radiation as well as from classical and anomalous transport are given. Effects of cold puff gas injection are also investigated.

INDEXES TO *ENERGY RESEARCH ABSTRACTS*

Five indexes are provided for approaching the contents of each issue of *Energy Research Abstracts (ERA)*. Each index is preceded by an introduction that details the organization of the index and the principles by which it was compiled. The reader is referred to these introductions for information not found in the index examples that follow.

• Corporate Author Index

Technical report literature is indexed using the name of the organization or institution responsible for the issuance of the report.

5785 (BMI/ONWI-522) Thermal property and density measurements of samples taken from drilling cores from potential geologic media. Lagedrost, J.F.; Capps, W. **(Fiber Materials, Inc., Biddeford, ME (USA)).** Dec. 1983. 179p. NTIS Order Number DE84004926. GPO Dep.

is indexed as:

Fiber Materials, Inc., Biddeford, ME (USA)

• Personal Author Index

Each author's name is indexed in the form appearing on the document abstracted, with the exception that given names are reduced to initials:

Capps, W., *See* Lagedrost, J. F.
Lagedrost, J.F., Thermal property and density measurements of samples taken from drilling cores from potential geologic media, 9:5785 (R;US)
McKenna, K.F., Equilibrium and power balance constraints on a quasi-static Ohmically heated field-reversed configuration (FRC), 9:15701 (J;US)
Rej, D.J., *See* McKenna, K.F.
Tuszewski, M., *See* McKenna, K.F.

• Subject Index

The subject index consisting of entries naming specific materials, objects, and processes is arranged alphabetically. Document titles, informative phrases, or both specific to these entries are arranged alphabetically under the entries.

SALT DEPOSITS
Density
Thermal property and density measurements of samples taken from drilling cores from potential geologic media, 9:5785 (R;US)
REVERSED-FIELD PINCH
Energy Balance
Equilibrium and power balance constraints on a quasi-static Ohmically heated field-reversed configuration (FRC), 9: 15701 (J;AT)

• Contract Number Index

DOE technical report literature is indexed using contract numbers. This index contains the contract number with corresponding abstract and report numbers.

AC06-76RL01830	**Fiber Materials, Inc., Biddeford, ME (USA)**	
	9:5785	BMI/ONWI-522

• Report Number Index

Technical report literature is also indexed using report numbers. This index includes information on where individual reports may be obtained. Patents and conference papers are indexed here as a matter of convenience. When a report is supplied under an Order Number, that number is included in the availability statement. An Order number–report number correlation is included for convenience.

BMI/ONWI-522	9:5785	NTIS, PC A09/MF A01. OSTI Order Number DE84004926, Distribution Category MN-70

INFORMATION SOURCES

The citations presented in *Energy Research Abstracts* are a subset of the worldwide energy information provided to the Office of Scientific and Technical Information (OSTI) through exchange agreements with foreign sources and through exchanges or contracts with U.S. organizations.

The **Energy Technology Data Exchange (ETDE)** was established by the International Energy Agency to promote cooperation among members in conducting appropriate energy-related research and development programs through the development of a formal central information sharing system. In accomplishing the objectives of the ETDE, members select, abstract, and index relevant research information published in their countries in accordance with Exchange standards. OSTI serves as the central receiving and processing center for this information, which it then disseminates to national centers in the participating countries. The following countries are currently members of the ETDE:

Canada
Denmark
Finland
France
Federal Republic of Germany
Italy
Japan
The Netherlands
Norway
Spain
Sweden
United Kingdom
United States

The **International Nuclear Information System (INIS)** was established to promote the exchange of information on nuclear science and technology. Its operation is similar to that of the ETDE, with the INIS Secretariat being located in Vienna, Austria. Currently, 75 countries and 14 international organizations are members of INIS. OSTI serves as the INIS national center for the United States.

In the exercise of its rights and responsibilities under the agreements to which it is a party, OSTI both receives information from the above sources and submits U.S.-produced information to them. In addition to materials generated by the Department of Energy, this U.S.-produced information is gathered from other government agencies as well as under contract with private information processing companies. All input is computer processed and entered into a data base for on-line retrieval. The data base serves as well for the production of numerous OSTI publications.

SUBJECT CONTENTS (NUMERICAL LISTING)

Six-digit subject category numbers are used in the storage, retrieval, and manipulation of bibliographic information entered into DOE's computerized bibliographic information system. The six-digit category numbers are utilized as if they were three pairs of two-digit numbers, the first two pairs being used to arrange the abstract content of *Energy Research Abstracts*. The following listing includes the totality of the 40 first-level and 289 second-level subject categories used. Because each issue of *ERA* announces only those documents becoming available during a semimonthly period, some subject categories may not be represented in every issue. The complete subject category scheme with scope definitions and limitations is availabie as DOE/TIC-4584-R6.

01 COAL AND COAL PRODUCTS
- 03 Preparation
- 04 Processing
- 05 By-Products
- 06 Properties
- 08 Waste Management
- 09 Environmental Aspects
- 10 Reserves and Exploration
- 20 Mining
- 30 Transport and Handling
- 40 Combustion
- 50 Marketing and Economics
- 60 Health and Safety
- 70 Legislation and Regulations

02 PETROLEUM
- 01 Reserves
- 02 Geology and Exploration
- 03 Drilling and Production
- 04 Processing
- 05 Products and By-Products
- 06 Health and Safety
- 07 Marketing and Economics
- 08 Waste Management
- 09 Environmental Aspects
- 10 Legislation and Regulation
- 20 Transport, Pipelines, and Handling
- 30 Properties
- 40 Storage
- 50 Combustion

03 NATURAL GAS
- 01 Reserves
- 02 Geology and Exploration
- 03 Drilling, Production, and Processing
- 04 Products and By-Products
- 05 Health and Safety
- 06 Marketing and Economics
- 07 Waste Management
- 08 Environmental Aspects
- 09 Artificial Stimulation
- 10 Legislation and Regulation
- 20 Transport, Pipelines, and Handling
- 30 Properties
- 40 Combustion
- 50 Storage

04 OIL SHALES AND TAR SANDS
- 01 Reserves and Exploration
- 02 Site Geology and Hydrology
- 03 Drilling, Fracturing, and Mining
- 04 Oil Production, Recovery, and Refining
- 05 Properties and Composition
- 06 Direct Uses and By-Products
- 07 Health and Safety
- 08 Marketing and Economics
- 09 Waste Research and Management
- 10 Environmental Aspects
- 20 Regulations

05 NUCLEAR FUELS
- 01 Reserves, Exploration, and Mining
- 04 Feed Processing
- 05 Uranium Enrichment
- 07 Fuels Production and Properties
- 08 Spent Fuels Reprocessing
- 09 Transport and Storage
- 10 Marketing, Economics, and By-Products
- 20 Waste Management
- 30 Environmental Aspects
- 40 Health and Safety
- 50 Safeguards, Inspection, and Accountability
- 60 Legislation and Regulations

07 ISOTOPE AND RADIATION SOURCE TECHNOLOGY
- 01 Physical Isotope Separation
- 02 Radiation Sources
- 03 Isotopic Power Supplies
- 04 Economics

08 HYDROGEN
- 01 Production
- 02 Storage
- 03 Transport
- 04 Marketing and Economics
- 05 Safety
- 06 Industrial and Commercial Use
- 07 By-Products
- 08 Properties
- 09 Environmental Aspects

09 OTHER SYNTHETIC AND NATURAL FUELS
- 01 Hydrocarbon Fuels
- 02 Alcohol Fuels
- 03 Inorganic Hydrogen Compound Fuels
- 04 Solid Waste and Wood Fuels
- 05 Liquid Waste Fuels
- 06 Gaseous Waste Fuels

13 HYDRO ENERGY
- 01 Resources and Availability
- 02 Site Geology and Meteorology
- 03 Plant Design and Operation
- 04 Regulations and Licensing
- 05 Economics and Management
- 06 Environmental Aspects
- 07 Power-Conversion Systems

14 SOLAR ENERGY
- 01 Resources and Availability
- 03 Economics
- 04 Environmental, Legal, and Institutional Aspects
- 05 Solar Energy Conversion
- 06 Photovoltaic Power Systems
- 07 Solar Thermal Power Systems
- 08 Ocean Energy Systems
- 09 Solar Thermal Utilization
- 10 Solar Collectors and Concentrators
- 20 Heat Storage

15 GEOTHERMAL ENERGY
- 01 Resource Status and Assessment
- 02 Geology and Hydrology of Geothermal Systems
- 03 Geothermal Exploration and Exploration Technology
- 04 Legal and Institutional Aspects
- 05 Economic and Financial Aspects
- 06 Environmental Aspects and Waste Disposal
- 07 By-Products
- 08 Geothermal Power Plants
- 09 Geothermal Engineering
- 10 Direct Energy Utilization
- 20 Geothermal Data and Theory

16 TIDAL AND WAVE POWER
- 03 Regulations
- 04 Economics
- 05 Environmental Aspects
- 07 Tidal Power Plants
- 08 Wave Energy Converters

17 WIND ENERGY
- 01 Availability (Climatology)
- 03 Regulations
- 04 Economics
- 05 Environmental Aspects
- 06 Wind Energy Engineering

20 ELECTRIC POWER ENGINEERING
- 01 Power Plants and Power Generation
- 02 Environmental Control Technology
- 03 Power Transmission and Distribution

21 NUCLEAR POWER PLANTS
- 01 Power Reactors, Nonbreeding, Light-Water Moderated, Boiling Water Cooled
- 02 Power Reactors, Nonbreeding, Light-Water Moderated, Non-boiling Water Cooled
- 03 Power Reactors, Nonbreeding, Graphite Moderated
- 04 Power Reactors, Nonbreeding, Otherwise Moderated or Unmoderated
- 05 Power Reactors, Breeding
- 06 Power Reactors, Auxiliary, Mobile, Package, and Transportable
- 07 Regulation and Licensing
- 08 Economics

22 NUCLEAR REACTOR TECHNOLOGY
- 01 Theory and Calculation
- 02 Components and Accessories
- 03 Fuel Elements
- 04 Control Systems
- 05 Environmental Aspects
- 06 Research, Test, and Experimental Reactors
- 07 Plutonium and Isotope Production Reactors
- 08 Propulsion Reactors
- 09 Reactor Safety

25 ENERGY STORAGE
- 01 Magnetic
- 02 Compressed Gas
- 03 Pumped Hydro
- 04 Capacitor Banks
- 05 Flywheels
- 06 Thermal
- 07 Liquefied Gas
- 08 Chemical
- 09 Batteries

29 ENERGY PLANNING AND POLICY
- 01 Energy Analysis and Modeling
- 02 Economics and Sociology
- 03 Environment, Health, and Safety
- 04 Natural Resources
- 05 Research, Development, Demonstration, and Commercialization
- 06 Nuclear Energy
- 07 Transport and Storage
- 08 Waste Heat Utilization
- 10 Conservation
- 20 Supply, Demand, and Forecasting
- 30 Policy, Legislation, and Regulation
- 40 Fossil Fuels
- 50 Hydrogen and Synthetic Fuels
- 60 Electric Power
- 80 Consumption and Utilization
- 90 Unconventional Sources and Power Generation

30 DIRECT ENERGY CONVERSION
- 01 MHD Generators
- 02 EHD Generators
- 03 Thermoelectric Generators
- 04 Thermionic Converters
- 05 Fuel Cells
- 08 Miscellaneous Converters

32 ENERGY CONSERVATION, CONSUMPTION, AND UTILIZATION
- 01 Buildings
- 02 Transportation
- 03 Industry and Agriculture
- 06 Municipalities and Community Systems
- 09 Education and Public Relations

33 ADVANCED AUTOMOTIVE PROPULSION SYSTEMS
- 01 Internal Combustion Engines
- 02 External Combustion Engines
- 03 Electric-Powered Systems
- 04 Hybrid Systems
- 05 Flywheel Propulsion
- 06 Vehicle Design Factors
- 07 Emission Control
- 08 Alternative Fuels

35 ARMS CONTROL
- 01 Policy, Negotiations, and Legislation
- 02 Proliferation
- 03 Verification

36 MATERIALS
- 01 Metals and Alloys
- 02 Ceramics, Cermets, and Refractories
- 06 Other Materials

40 CHEMISTRY
- 01 Analytical and Separations Chemistry
- 02 Inorganic, Organic, and Physical Chemistry
- 04 Electrochemistry
- 05 Photochemistry
- 06 Radiation Chemistry
- 07 Radiochemistry and Nuclear Chemistry
- 08 Combustion, Pyrolysis, and High-Temperature Chemistry

42 ENGINEERING
- 02 Facilities and Equipment
- 03 Lasers
- 04 Heat Transfer and Fluid Flow
- 05 Materials Testing
- 08 Electronic Circuits and Devices
- 09 Waste Processing Plants and Equipment
- 10 Combustion Systems
- 20 Underground Engineering
- 30 Marine Engineering
- 40 Pollution Control Equipment
- 50 Power Cycles

43 PARTICLE ACCELERATORS
- 01 Design, Development, and Operation
- 02 Beam Dynamics, Field Calculations, and Ion Optics
- 03 Auxiliaries and Components
- 04 Storage Rings

44 INSTRUMENTATION
- 01 Radiation Instrumentation
- 02 Radiation Effects on Instrument Components, Instruments, or Electronic Systems
- 03 Miscellaneous Instruments
- 04 Well Logging Instrumentation

45 EXPLOSIONS AND EXPLOSIVES
- 01 Chemical
- 02 Nuclear
- 03 Explosion Detection

50 ENVIRONMENTAL SCIENCES, ATMOSPHERIC
- 01 Basic Studies
- 02 Chemicals Monitoring and Transport
- 03 Radioactive Materials Monitoring and Transport
- 04 Thermal Effluents Monitoring and Transport
- 05 Site Resource and Use Studies
- 06 Regulations

51 ENVIRONMENTAL SCIENCES, TERRESTRIAL
- 01 Basic Studies
- 02 Chemicals Monitoring and Transport
- 03 Radioactive Materials Monitoring and Transport
- 04 Thermal Effluents Monitoring and Transport
- 05 Site Resource and Use Studies
- 06 Regulations

52 ENVIRONMENTAL SCIENCES, AQUATIC
- 01 Basic Studies
- 02 Chemicals Monitoring and Transport
- 03 Radioactive Materials Monitoring and Transport
- 04 Thermal Effluents Monitoring and Transport
- 05 Site Resource and Use Studies
- 06 Regulations

53 ENVIRONMENTAL—SOCIAL ASPECTS OF ENERGY TECHNOLOGIES
- 01 Social and Economic Studies
- 02 Assessment of Energy Technologies

55 BIOMEDICAL SCIENCES, BASIC STUDIES
- 01 Behavioral Biology
- 02 Biochemistry
- 03 Cytology

55 BIOMEDICAL SCIENCES, BASIC STUDIES (CONT.)
04 Genetics
05 Metabolism
06 Medicine
07 Microbiology
08 Morphology
09 Pathology
10 Physiological Systems
20 Public Health
30 Agriculture and Food Technology

56 BIOMEDICAL SCIENCES, APPLIED STUDIES
01 Radiation Effects
02 Thermal Effects
03 Chemicals Metabolism and Toxicology
04 Other Environmental Pollutant Effects

57 HEALTH AND SAFETY

58 GEOSCIENCES
01 Geology and Hydrology
02 Geophysics
03 Mineralogy, Petrology, and Rock Mechanics
04 Geochemistry
05 Oceanography

64 PHYSICS I
01 Astrophysics and Cosmology
02 Atmospheric Physics
03 Atomic, Molecular, and Chemical Physics
04 Fluid Physics
50 High Energy Physics

65 PHYSICS II
10 Nuclear Physics
12-20 Nuclear Properties and Reactions
30 Nuclear Theory
40 Radiation and Shielding Physics
50 Medical Physics
60 Condensed Matter Physics
61 Superconductivity
70 Theoretical and Mathematical Physics

70 FUSION ENERGY
01 Plasma Research
02 Fusion Power Plant Technology

99 GENERAL AND MISCELLANEOUS
01 Management
02 Mathematics and Computers
03 Information Handling
04 Law
05 Civilian Defense

CORPORATE AUTHOR INDEX

PERSONAL AUTHOR INDEX

SUBJECT INDEX

CONTRACT NUMBER INDEX

REPORT NUMBER INDEX

ORDER NUMBER CORRELATION

SUBJECT CONTENTS (ALPHABETICAL LISTING)

Six-digit subject category numbers are used in the storage, retrieval, and manipulation of bibliographic information entered into DOE's computerized bibliographic information system. The six-digit category numbers are utilized as if they were three pairs of two-digit numbers, the first two pairs being used to arrange the abstract content of *Energy Research Abstracts*. The following listing includes the totality of the 40 first-level and 289 second-level subject categories used. Because each issue of *ERA* announces only those documents becoming available during a semimonthly period, some subject categories may not be represented in every issue. The complete subject category scheme with scope definitions and limitations is available as DOE/TIC-4584-R6.

33 ADVANCED AUTOMOTIVE PROPULSION SYSTEMS
- 08 Alternative Fuels
- 03 Electric-Powered Systems
- 07 Emission Control
- 02 External Combustion Engines
- 05 Flywheel Propulsion
- 04 Hybrid Systems
- 01 Internal Combustion Engines
- 06 Vehicle Design Factors

35 ARMS CONTROL
- 01 Policy, Negotiations, and Legislation
- 02 Proliferation
- 03 Verification

56 BIOMEDICAL SCIENCES, APPLIED STUDIES
- 03 Chemicals Metabolism and Toxicology
- 04 Other Environmental Pollutant Effects
- 01 Radiation Effects
- 02 Thermal Effects

55 BIOMEDICAL SCIENCES, BASIC STUDIES
- 30 Agriculture and Food Technology
- 01 Behavioral Biology
- 02 Biochemistry
- 03 Cytology
- 04 Genetics
- 06 Medicine
- 05 Metabolism
- 07 Microbiology
- 08 Morphology
- 09 Pathology
- 10 Physiological Systems
- 20 Public Health

40 CHEMISTRY
- 01 Analytical and Separations Chemistry
- 08 Combustion, Pyrolysis, and High-Temperature Chemistry
- 04 Electrochemistry
- 02 Inorganic, Organic, and Physical Chemistry
- 05 Photochemistry
- 06 Radiation Chemistry
- 07 Radiochemistry and Nuclear Chemistry

01 COAL AND COAL PRODUCTS
- 05 By-Products
- 40 Combustion
- 09 Environmental Aspects
- 60 Health and Safety
- 70 Legislation and Regulations
- 50 Marketing and Economics
- 20 Mining
- 03 Preparation
- 04 Processing
- 06 Properties
- 10 Reserves and Exploration
- 30 Transport and Handling
- 08 Waste Management

30 DIRECT ENERGY CONVERSION
- 02 EHD Generators
- 05 Fuel Cells
- 01 MHD Generators
- 08 Miscellaneous Converters
- 04 Thermionic Converters
- 03 Thermoelectric Generators

20 ELECTRIC POWER ENGINEERING
- 02 Environmental Control Technology
- 01 Power Plants and Power Generation
- 03 Power Transmission and Distribution

32 ENERGY CONSERVATION, CONSUMPTION, AND UTILIZATION
- 01 Buildings
- 09 Education and Public Relations
- 03 Industry and Agriculture
- 06 Municipalities and Community Systems
- 02 Transportation

29 ENERGY PLANNING AND POLICY
- 10 Conservation
- 80 Consumption and Utilization
- 02 Economics and Sociology
- 60 Electric Power
- 01 Energy Analysis and Modeling
- 03 Environment, Health, and Safety
- 40 Fossil Fuels
- 50 Hydrogen and Synthetic Fuels
- 04 Natural Resources
- 06 Nuclear Energy
- 30 Policy, Legislation, and Regulation
- 05 Research, Development, Demonstration, and Commercialization
- 20 Supply, Demand, and Forecasting
- 07 Transport and Storage
- 90 Unconventional Sources and Power Generation
- 08 Waste Heat Utilization

25 ENERGY STORAGE
- 09 Batteries
- 04 Capacitor Banks
- 08 Chemical
- 02 Compressed Gas
- 05 Flywheels
- 07 Liquefied Gas
- 01 Magnetic
- 03 Pumped Hydro
- 06 Thermal

42 ENGINEERING
- 10 Combustion Systems
- 08 Electronic Circuits and Devices
- 02 Facilities and Equipment
- 04 Heat Transfer and Fluid Flow
- 03 Lasers
- 30 Marine Engineering
- 05 Materials Testing
- 40 Pollution Control Equipment
- 50 Power Cycles
- 20 Underground Engineering
- 09 Waste Processing Plants and Equipment

52 ENVIRONMENTAL SCIENCES, AQUATIC
- 01 Basic Studies
- 02 Chemicals Monitoring and Transport
- 03 Radioactive Materials Monitoring and Transport
- 06 Regulations
- 05 Site Resource and Use Studies
- 04 Thermal Effluents Monitoring and Transport

50 ENVIRONMENTAL SCIENCES, ATMOSPHERIC
- 01 Basic Studies
- 02 Chemicals Monitoring and Transport
- 03 Radioactive Materials Monitoring and Transport
- 06 Regulations
- 05 Site Resource and Use Studies
- 04 Thermal Effluents Monitoring and Transport

51 ENVIRONMENTAL SCIENCES, TERRESTRIAL
- 01 Basic Studies
- 02 Chemicals Monitoring and Transport
- 03 Radioactive Materials Monitoring and Transport
- 06 Regulations
- 05 Site Resource and Use Studies
- 04 Thermal Effluents Monitoring and Transport

53 ENVIRONMENTAL—SOCIAL ASPECTS OF ENERGY TECHNOLOGIES
- 02 Assessment of Energy Technologies
- 01 Social and Economic Studies

45 EXPLOSIONS AND EXPLOSIVES
- 01 Chemical
- 03 Explosion Detection
- 02 Nuclear

70 FUSION ENERGY
- 02 Fusion Power Plant Technology
- 01 Plasma Research

99 GENERAL AND MISCELLANEOUS
- 05 Civilian Defense
- 03 Information Handling
- 04 Law
- 01 Management
- 02 Mathematics and Computers

58 GEOSCIENCES
- 04 Geochemistry
- 01 Geology and Hydrology
- 02 Geophysics
- 03 Mineralogy, Petrology, and Rock Mechanics
- 05 Oceanography

15 GEOTHERMAL ENERGY
- 07 By-Products
- 10 Direct Energy Utilization
- 05 Economic and Financial Aspects
- 06 Environmental Aspects and Waste Disposal
- 02 Geology and Hydrology of Geothermal Systems
- 20 Geothermal Data and Theory
- 09 Geothermal Engineering
- 03 Geothermal Exploration and Exploration Technology
- 08 Geothermal Power Plants
- 04 Legal and Institutional Aspects
- 01 Resource Status and Assessment

57 HEALTH AND SAFETY

13 HYDRO ENERGY
- 05 Economics and Management
- 06 Environmental Aspects
- 03 Plant Design and Operation
- 07 Power-Conversion Systems
- 04 Regulations and Licensing
- 01 Resources and Availability
- 02 Site Geology and Meteorology

08 HYDROGEN
- 07 By-Products
- 09 Environmental Aspects
- 06 Industrial and Commercial Use
- 04 Marketing and Economics
- 01 Production
- 08 Properties
- 05 Safety
- 02 Storage
- 03 Transport

44 INSTRUMENTATION
- 03 Miscellaneous Instruments
- 02 Radiation Effects on Instrument Components, Instruments, or Electronic Systems
- 01 Radiation Instrumentation
- 04 Well Logging Instrumentation

07 ISOTOPE AND RADIATION SOURCE TECHNOLOGY
- 04 Economics
- 03 Isotopic Power Supplies
- 01 Physical Isotope Separation
- 02 Radiation Sources

36 MATERIALS
- 02 Ceramics, Cermets, and Refractories
- 01 Metals and Alloys
- 06 Other Materials

03 NATURAL GAS
- 09 Artificial Stimulation
- 40 Combustion
- 03 Drilling, Production, and Processing
- 08 Environmental Aspects
- 02 Geology and Exploration
- 05 Health and Safety
- 10 Legislation and Regulation
- 06 Marketing and Economics
- 04 Products and By-Products
- 30 Properties
- 01 Reserves
- 50 Storage
- 20 Transport, Pipelines, and Handling
- 07 Waste Management

05 NUCLEAR FUELS
- 30 Environmental Aspects
- 04 Feed Processing
- 07 Fuels Production and Properties
- 40 Health and Safety
- 60 Legislation and Regulations
- 10 Marketing, Economics, and By-Products
- 01 Reserves, Exploration, and Mining
- 50 Safeguards, Inspection, and Accountability
- 08 Spent Fuels Reprocessing
- 09 Transport and Storage
- 05 Uranium Enrichment
- 20 Waste Management

21 NUCLEAR POWER PLANTS
- 08 Economics
- 06 Power Reactors, Auxiliary, Mobile, Package, and Transportable
- 05 Power Reactors, Breeding
- 03 Power Reactors, Nonbreeding, Graphite Moderated
- 01 Power Reactors, Nonbreeding, Light-Water Moderated, Boiling Water Cooled
- 02 Power Reactors, Nonbreeding, Light-Water Moderated, Non-boiling Water Cooled
- 04 Power Reactors, Nonbreeding, Otherwise Moderated or Unmoderated
- 07 Regulation and Licensing

22 NUCLEAR REACTOR TECHNOLOGY
- 02 Components and Accessories
- 04 Control Systems
- 05 Environmental Aspects
- 03 Fuel Elements
- 07 Plutonium and Isotope Production Reactors
- 08 Propulsion Reactors
- 09 Reactor Safety
- 06 Research, Test, and Experimental Reactors
- 01 Theory and Calculation

04 OIL SHALES AND TAR SANDS
- 06 Direct Uses and By-Products
- 03 Drilling, Fracturing, and Mining
- 10 Environmental Aspects
- 07 Health and Safety
- 08 Marketing and Economics
- 04 Oil Production, Recovery, and Refining
- 05 Properties and Composition
- 20 Regulations
- 01 Reserves and Exploration
- 02 Site Geology and Hydrology
- 09 Waste Research and Management

09 OTHER SYNTHETIC AND NATURAL FUELS
- 02 Alcohol Fuels
- 06 Gaseous Waste Fuels
- 01 Hydrocarbon Fuels
- 03 Inorganic Hydrogen Compound Fuels
- 05 Liquid Waste Fuels
- 04 Solid Waste and Wood Fuels

43 PARTICLE ACCELERATORS
- 03 Auxiliaries and Components
- 02 Beam Dynamics, Field Calculations, and Ion Optics
- 01 Design, Development, and Operation
- 04 Storage Rings

02 PETROLEUM
- 50 Combustion
- 03 Drilling and Production
- 09 Environmental Aspects
- 02 Geology and Exploration
- 06 Health and Safety
- 10 Legislation and Regulation
- 07 Marketing and Economics
- 04 Processing
- 05 Products and By-Products
- 30 Properties
- 01 Reserves
- 40 Storage
- 20 Transport, Pipelines, and Handling
- 08 Waste Management

64 PHYSICS I
- 01 Astrophysics and Cosmology
- 02 Atmospheric Physics
- 03 Atomic, Molecular, and Chemical Physics
- 04 Fluid Physics
- 50 High Energy Physics

65 PHYSICS II
- 60 Condensed Matter Physics
- 50 Medical Physics
- 10 Nuclear Physics
- 12-20 Nuclear Properties and Reactions
- 30 Nuclear Theory
- 40 Radiation and Shielding Physics
- 61 Superconductivity
- 70 Theoretical and Mathematical Physics

14 SOLAR ENERGY
- 03 Economics
- 04 Environmental, Legal, and Institutional Aspects
- 20 Heat Storage
- 08 Ocean Energy Systems
- 06 Photovoltaic Power Systems
- 01 Resources and Availability
- 10 Solar Collectors and Concentrators
- 05 Solar Energy Conversion
- 07 Solar Thermal Power Systems
- 09 Solar Thermal Utilization

16 TIDAL AND WAVE POWER
- 04 Economics
- 05 Environmental Aspects
- 03 Regulations
- 07 Tidal Power Plants
- 08 Wave Energy Converters

17 WIND ENERGY
- 01 Availability (Climatology)
- 04 Economics
- 05 Environmental Aspects
- 03 Regulations
- 06 Wind Energy Engineering

CORPORATE AUTHOR INDEX

PERSONAL AUTHOR INDEX

SUBJECT INDEX

CONTRACT NUMBER INDEX

REPORT NUMBER INDEX

ORDER NUMBER CORRELATION

ENERGY RESEARCH ABSTRACTS

01 COAL AND COAL PRODUCTS

0103 Preparation

REFER ALSO TO CITATION(S) 10640, 10665

10602 **(CMRC—80/13-T) Coal preparation in the 1980s.** Irwin, W.; Butcher, S.G.; Le der, W.R.; Osborne, D.G. (Coal Mining Research Centre, Edmonton, Alberta (Canada)). 1980. 40p. (CONF-8004117—; CE—02172). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

From 82. AGM Canadian Institute of Mining and Metallurgy; Toronto, Canada (20 Apr 1980).

This paper outlines the distinctive characteristics pertaining to the treatment of metallurgical and thermal coals in Canada, and development trends in plant and equipment design relating to each specific product type are discussed. Research and development to improve plant performance is reviewed in relation to the Canadian coal industry and its markets. Suggestions are presented for increasing the dialogue between operators and researchers for improving training schemes. Principal conclusions are summarized as follows. The diversity in the range of Canadian coals dictates that preparation be matched to the individual coal and its utilization. Efficiency in fines recovery warrants special consideration: the experience already gained in Canada with uniquely friable coals should be fully exploited. Coal preparation plants will be simpler and more streamlined with a trend towards modular design using larger capacity equipment. New preparation facilities should include homogenization or blending, particularly when producing partially treated coals for expanding thermal markets. Research and development programmes are expanding in response to a greater awareness of recurring plant operational problems and demands of new markets. In the 1980s plans for more effective technical forums and education must be implemented. 2 figs.

10603 **(ITL-JULK—02/86) Forecast method for potential evaporation.** Venaelaeinen, A. (Finnish Meteorological Inst., Helsinki). 1986. 45p. (In Finnish). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755769/JAW.

The development of a forecasting model for evaporation was initiated in winter 1984 on the Finnish peat producers' request. The method is based on the so called Penman-Monteith equation. As input data the model needs average forecasted values of air temperature, air humidity, cloudiness and wind speed for the forecasting period. These are provided by the duty meteorologist. Main reasons leading to errors in evaporation forecasts are inaccuracies in the wind speed and cloudiness forecasts. During summer 1985 evaporation forecasts were made for almost one hundred peat producing areas. The amount of inaccurate forecasts varied between 25 and 40 percent depending on the forecast range. According to experiences it seems that evaporation can be forecasted with a reasonable accuracy.

10604 **(KTM/E-D—153) Artificial dewatering of peat.** Pirkkonen, P.; Aho, M.; Luukkainen, V.-M.; Peltola, T.; Thun, R.; Johnsson, P. (Valtion Teknillinen Tutkimuskeskus, Espoo (Finland)). (Kauppa-ja Teollisuusministerio, Helsinki (Finland). Energiaosasto). Mar 1988. 283p. (In Finnish). NTIS (US Sales Only), PC A13/MF A01. Order Number DE88755775/JAW.

New information produced by a study of the literature and by outstanding experimental research is presented is this publication. The subjects dealt with are peat production methods based on artifical dewatering, peat structure, and the waterbinding properties of peat. Peat production methods (wet) were presented by means of a study of the literature. The physical/chemical structure and waterbinding properties of the most common Finnish peat types were studied by several moden methods. The devices and the processes used described in the literature for mechanical, thermal and chemical dewatering of peat are presented extensively. The effects relating to mechanical, thermal and chemical dewatering were observed by means of the literature and on the basis of both small and large scale dewatering studies. On the basis of the studies carried out the peat produced by artificial dewatering methods is not yet economically equal to conventionally produced peat. The methods still need much development work and they will become feasible first of all in the northern marshlands where solar energy can only be utilized to a limited extent.

10605 **(STEV-TB—88-7) Peat drying trials with a tray-rack.** Malmberg, L. (Statens Energiverk, Stockholm (Sweden)). 1988. 30p. (In Swedish). (SLU-ISK-U—101-1987). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755883/JAW.

The main problem when harvesting peat with small-scale-system is that invested capital in machines and other equipment often gets a poor utilization due to the fact that the drying time takes a lot longer than the time for harvesting peat. There is even a higher cost per ha to prepare a small peatbog for harvesting than a big one. The purpose of this study was to compare the drying development of peat drying at field and peat drying in a rack. The rack is made of a wooden frame with rails of angle-iron. Trays (1x1 m) were placed on the angle-irons to put peat on for drying. The dimension of the rack is almost the same as the standard for transportation. It is of great interest in peat production to get the moisture content down to 35 percent. The variables which were primarily found to have an influence on the drying in this study were: Time, Level (in rack or at field), Traymaterial, Shape of the peatpieces and degree of humification. The calculated drying times show differences in the drying development between the stand and the field. The effect is most obvious late in the season. It has been possible to extend the production season a lot, using the rack.

10606 **(TKK-KO/ET—27) Use of magnetite fluidized bed in a steam dryer of milled peat.** Isoniemi, M.; Wilen, C.; Huhtinen, M.; Jahkola, A. (Helsinki Univ. of Technology, Otaniemi (Finland). Inst. of Energy Engineering). Jun 1988. 74p. (In Finnish). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88755923/JAW.

Steam heated steam fluidized bed drying of milled peat has been studied at Helsinki University of Technology in the Laboratory of Energy Economics and Power Plant Engineering since 1984, the target of the studies has been to develop an alternative drying method for fluegas drying. The main advantage of drying with steam is the possibility to recover most of the energy required for drying by condensing the evaporated moisture at temperature respective to the dryer's pressure. On the basis of earlier experiments it has been concluded to two possible bed materials in fluidized bed drying: peat and magnetite (FeO/sub 3/). The advantage of dryer with peat as bed material is simplicity but its heat transfer properties are poor which causes large dryer size. When magnetite is used as bed material better heat transfer is achieved but the required fan power for fluidizing the bed is increased. The target of this work was to experimentally study the heat transfer between the fluidized bed and the heat transfer surface when magnetite is used as bed material. In addition, a dimensioning program for the components of steam fluidized bed dryer was made. Drying experiments of peat with magnetite bed were carried out using two different particle sizes. It was also studied, which effects fluidizing velocity and ac-

cumulation of peat into bed have. A steam fluidized bed dryer improves the efficiency of energy production of a power plant. It is a rather large investment so its competitivity is at its best in large units. Before building commercial dryers of large capacity the reliability of the method has to be proved at a demonstration plant of smaller scale. On the basis of the measurements a steam fluidized bed dryer was dimensioned to district heating power plant with both magnetite and peat bed alternatives. When the capital and operating costs of those were calculated the peat bed dryer was found more economical in this case.

0104 Processing

REFER ALSO TO CITATION(S) 10634

10607 **(ARC/CR—8204) Rapid heating short residence time liquefaction of Alberta subbituminous coals: miniautoclave tests.** Parkash, S.; Carson, D.; Soderline, J. (Alberta Research Council, Edmonton (Canada). Coal Research Dept.). 1982. 81p. (CE—02223). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

Rapid heating short resistance time (RHSRT) liquefaction experiments in a 130 ml autoclave were conducted with three subbituminous coals from the Alberta Plains. Liquefaction conditions were representative of the I.G. Farben and CO-steam process types. Among the process variables studied were the effects of temperature, residence time, nature of solvent and the presence or absence of a catalyst. The total conversion yields (weight percent, dry ash free basis) were based on tetrahydrofuran (THF) insolubles. Optimum conversions obtained for the three coals range from 57-66% (Farben) and 75-82% (CO/steam). For all three coals, higher conversions were obtained with CO-steam at lower temperatures (400/sup 0/C) than with I.G. Farben (460/sup 0/C). However, based on thermogravimetric analyses of liquid products, the latter process type yielded more liquids in the light medium oil boiling range (100/sup 0/-300/sup 0/C). Conversions could be improved only marginally by controlling the residence time and the temperature. Tetralin was more effective in promoting solvation and gave a better conversion than anthracene oil. Potassium molybdate catalyst was superior to iron oxide while iron ore had no discernable catalytic effect. Petrographic analyses of the residues (THF insolubles) indicated that a major portion of vitrinite was solubilized and the remaining converted to plastic cenospheres, granular residue and semicoke. Semifusinite solubilized partially and the unreacted portion appeared in the residue and merged with fusinite. 29 figs., 23 tabs.

10608 **(ARC/CR—8306) ENR-ARC Coal Conversion Research Program. First quarter progress report April 1, 1983 - June 30, 1983.** Chakrabartty, S.K.; du Plessis, M.P. (Alberta Research Council, Edmonton (Canada). Coal Research Dept.). 1983. 100p. (CE—02145). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

Research projects are being conducted to evaluate major Alberta subbituminous coals for conversion by liquefaction and pyrolysis processes. This report covers the activities of these projects and related programs, such as the Coal Technology Information Centre, analytical support services, and cooperative programs with other research centres. Some highlights are as follows. Batch autoclave tests were carried out on the liquefaction of designated coals using the H-coal, donor solvent, and solvolysis processes. Promising high oil yields were obtained using the hot charge discharge liquefaction unit with coal and bitumen. Low temperature rheological studies were completed on coal-anthracene oil and coal-bitumen slurries. Pyrolysis test runs on a mini-reactor and a bench unit were completed. Major and minor elements of ash from six sample coals were analyzed using inductively coupled argon plasma spectrometry. Data for six coals and five liquefaction process types evaluated during 1981-83 were reviewed and analyzed; a major objective was to develop reliable procedures for comparative evaluation of coals and process conditions based on both coal conversion and product quality. Thin layer chromatography was shown to be a reliable method for comparing the effects of process conditions on product quality (hydrocarbons, asphaltenes, preasphaltenes). 11 refs., 21 figs., 43 tabs.

10609 **(ARC/CR—8311) Flash pyrolysis/hydropyrolysis of Alberta subbituminous coals: design, construction, operation and initial results of a high pressure 1-5 kg/hour bench unit.** Gangwal, S.K.; Mendiuk, J. (Alberta Research Council, Edmonton (Canada). Coal Research Dept.). 1983. 68p. (CE—02224). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

A 5 kg/h bench unit facility has been constructed and commissioned for flash pyrolysis of Alberta thermal coals. The long term objective is to evaluate the technoeconomic potential of those coals in producing valuable liquid products (suitable for production of distillate fuels and petrochemical feedstocks) prior to burning the solid char co-product in a conventional pulverized coal-fired power plant. Shakedown and preliminary screening runs have been performed with three subbituminous coals (Highvale, Vesta and Sissons) in an intrained flow reactor system at pressures from 800 to 600 psi, temperatures from 600 to 800/sup 0/ C, rector residence times from 1.3 to 2.4 s and gas-to-coal weight ratios from 0.9 to 6. The design, construction and operation of the bench unit is described. Main conclusions from the results are the higher conversion of coal can be obtained with hydrogen as the entraining gas (flash hydropyrolysis) as opposed to helium (flash pyrolysis). More liquids (heavy oils and light oils) are produced from hydropyrolysis, but more water is also produced. Among the experimental conditions tested, the maximum amount of liquids (12.4 wt%) were produced from hydropyrolysis of Highvale coal at 8.1 megapascals, 700/sup 0/C, 2.4 s vapor residence time and gas-to-coal weight ratio of 0.9. 32 refs., 17 figs., 14 tabs.

10610 **(ARC/CR—FY1982/83) The liquefaction of Alberta subbituminous coals: batch autoclave and mini-autoclave tests. Annual progress report, 1983.** Moschopedis, S.E. (Alberta Research Council, Edmonton (Canada). Coal Research Dept.). 1983. 65p. (CE—02165). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

The objectives of this report are to evaluate Alberta subbituminous coals under optimum conditions established for the I.G. Farben, CO/steam, dispersed catalyst, coal-bitumen, and short residence time processes of coal liquefaction. Batch tests were conducted in a stainless steel magnetically-stirred autoclave, and standard work-up procedures were used. For the mini-autoclave tests, a 35 cc bomb was used and experiments were performed under established conditions. The data indicate relatively small differences in the reactivity of the 3 coals tested under optium conditions for each of the first four processes. Oil soluble salts are more effective catalysts in the third process. The effects of hydrogen sulfide and carbon disulfide on the percent conversion and product distribution were also studied. The results show that their presence in the reaction mixture increases the yields of distillable oils and extraction products. At temperatures over 400/sup 0/C the yields of gas products increase at the expense of distillates and extracts, using the second process. With a raise in temperature, an overall increase of the wt% of naphtha and volatile hydrocarbons occurred, in the fourth process. The results from the fifth process (mini-autoclave tests) show that, except when the North Dakota solvent was used, conversions are the same as under the first two processes. 9 refs., 19 figs., 23 tabs.

10611 **(ARC/CR—YCLQ-13) Co-processing of coal with oil sands, bitumen and derivatives. Batch autoclave tests.** Moschopedis, S.E.; Hawkins, R.W.; Wasylyk, H. (Alberta Research Council, Edmonton (Canada). Coal Research Dept.). 1983. 65p. (CE—02146). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

The report describes the co-processing of Alberta subbituminous coals with oil sands bitumen, with liquids derived from bitu-

men and with Lloydminster heavy oil. The objectives for this report are to evaluate the liquids mentioned above as solvents for the liquefaction of Alberta's subbituminous coals, and to compare the results with those obtained using anthracene oil, a coal derived solvent. Three types of subbituminous coals were used as feedstock for co-processing under two different sets of experimental conditions: the hydroliquefaction process using Fe/sub 2/O/sub 3/ catalyst; and the CO/steam process with K/sub 2/CO/sub 3/ catalyst. Batch autoclave tests were conducted in a stainless steel magnetically stirred autoclave equipped with an internal cooling system for rapid cooling. The data indicate that subbituminous coals can be solubilized by these solvents. However, the extent of liquefaction yields and product distribution vary and depend upon the type of coal and solvent and on the reaction conditions. Results obtained with different coals range from 84-98% conversion using hydroliquefaction and 83-96% using the CO/steam process. Using solvents in hydroliquefaction, conversion ranged from 72% using Suncor coker gas oil to 84% using Suncor bitumen. 14 refs., 6 figs., 14 tabs.

10612 **(ARC/CR—YCLQ19) Effect of added H/sub 2/S or CS/sub 2/ on the liquefaction of Alberta subbituminous coals in I.G. Farben and CO/steam process types.** du Plessis, M.P. (Alberta Research Council, Edmonton (Canada). Coal Research Dept.). 1983. 42p. (CE—02143). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

This report describes results of batch autoclave liquefaction tests carried out with Alberta subbituminous coal, anthracene oil and catalysts. The objectives of this program were to examine the influence of H/sub 2/S/CS/sub 2/ on coal conversion and liquid products yield in two liquefaction process types: H/sub 2/ in presence of Fe/sub 2/CO/sub 3/(I.G. Farben) and CO/steam in presence of K/sub 2/CO/sub 3/; to evaluate the catalytic effect of H/sub 2/S/CS/sub 2/ in liquefaction reactions without heterogeneous catalysts; and determine the difference, if any, in liquefaction yields when sulfur is introduced either as H/sub 2/S or CS/sub 2/. The experiments confirmed that, under process conditions investigated the efficiency of both liquefaction processes was increased significantly (I.G. Farben > CO/steam) in terms of coal conversion and liquid yield as well as in liquid product selectivity. Better results were obtained with H/sub 2/S than with CS/sub 2/. The major advantages of using H/sub 2/S are: increased coal conversion into liquid yields; improved activity of heterogeneous catalysts (presulfiding); improved selectivity in liquids generation; and high product recovery. Also, H/sub 2/S performs as an effective, inexpensive catalyst itself, and is of particular interest because of its ready availability in Alberta as a by-product from sour gas and heavy oil processing plants. 5 refs., 7 figs., 22 tabs.

10613 **(ARC/CR—YCLQ-26) Evaluation of subbituminous coals of Alberta reaction of Ardley, Judy Creek and Fox Creek coals with carbon monoxide and steam (PC2 process).** Gawlak, M; Carson, D.; Shatilla, N.; Wasylyk, H. (Alberta Research Council, Edmonton (Canada). Coal Research Dept.). 1983. 30p. (CE—02150). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

Reactivity of subbituminous Alberta coals was compared in the PC2 process, the reaction of coal with carbon monoxide and steam. Autoclave liquefaction tests were carried out using anthracene oil and K/sub 2/CO/sub 3/ and a CO pressure of 1,000 psi. Reaction time in all the experiments was 30 min. Reaction temperature, amount of catalyst, water and CO were varied for optimization of liquefaction conditions. Judy Creek coal (washed) gave highest conversion at 91%; Fox Creek (washed) and Ardley coal both gave 84% conversion. Optimum reaction conditions for PC2 process were found to be reaction temperature of 380-400/sup 0/C; water/coal ratio ≧ 0.38 and carbon monoxide pressure ≧600 psi cold. At conversion temperatures above 400/sup 0/C the yields of useful reaction products drop, and the production of gases increases. Of the six coals tested so far in the PC2 process, Vesta Mine coal gave highest conversion at 95%, Smoky Tower and Judy Creek coals gave 90 and 91% conversion, respectively, and Fox Creek, Highvale and Ardley coals gave conversions of 84%, 84% and 82% respectively. However, Fox Creek coal gave the highest yield of useful conversion products, defined as the pyridine extract plus distillable liquids. 11 figs., 5 tabs.

10614 **(ARC/CR—YCLQ-27) Evaluation of subbituminous coals of Alberta conversion of Ardley, Judy Creek and Fox Creek coals in dispersed catalyst process.** Wasylyk, H. (Alberta Research Council, Edmonton (Canada). Coal Research Dept.). 1983. 17p. (CE—02141). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

Batch autoclave experiments were carried out on three coals using the dispersed catalyst process, a hydrogenation process which uses ultrasonic vibration to efficiently disperse in the reaction medium an aqueous solution of catalyst. The advantage of the process lies in improved contact with the catalyst which, in turn, is reflected in its greater activity. As an extension of catalyst dispersion, oil soluble salts of corresponding metals were also tested. The experimental program consisted of two parts: comparison of reactivity of the coals under standard reaction conditions with potassium molybdate and ferrous sulfate catalysts; and comparison of activity of various catalysts, under standard reaction conditions using the same coal. Reactivity of coals was measured by their conversion. It was found that potassium molybdate was the most effective water-soluble catalyst for the dispersed catalyst process. The results of catalyst reactivity tests lead to the following generalizations. Oil-soluble naphthenates are more active in coal conversion than are water-soluble naphthenates of the same metals. Of the sulfate catalysts tested, cobalt sulfate was the most reactive. Addition of zinc to cobalt did not increase the reactivity of cobalt. Aqueous, sonically dispersed potassium molybdate and oil-soluble cobalt naphthenate gave approximately equal conversion of Ardley and Highvale coals. Both coals gave the same order of catalyst reactivity: potassium molybdenate = cobalt or cobalt/zinc naphthenates > cobalt sulfate = iron naphthenate > cobalt/zinc sulfates > iron sulfates > iron oxide > chromium sulfate. 5 tabs.

10615 **(ARC/CR—YCLQ-28) Behavioural differences between two solvents in liquefaction of Alberta subbituminous coal with hydrogen and Fe/sub 2/O/sub 3/ catalyst.** Lewkowicz, L.; Badree, K.; Ignasiak, B. (Alberta Research Council, Edmonton (Canada). Coal Research Dept.). 1983. 21p. (CE—02148). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

This report describes results of batch autoclave liquefaction tests carried out with Alberta subbituminous Wabamun coal, either in Saarbergwerke Process Oil (SPO) or Anthracene non-hydrogenated Oil (AO), employing conditions typical of the I.G. Farben process type. The objectives of this program were to compare the behaviour of SPO and AO on liquefaction with H/sub 2/ in presence of Fe/sub 2/O/sub 3/ as a catalyst; obtain accurate elemental balances (H and O) for some of the tests; and evaluate the effect of phenols removal from SPO. The experiments partly confirmed the results of previous work, namely that I.G. Farben process type coal liquefaction tests of Wabamun coal with SPO give different water balances than tests with AO. Water recovery has positive values in the runs with SPO and has positive or negative values with AO. Good hydrogen balances were obtained (92 - 97%) but oxygen balances were poor. A limited number of tests were conducted with AO and Wabamun coal containing different moisture contents. No definite correlation was observed between moisture content in the coal and water recovery, H/sub 2/ consumption or CO/sub 2/ generated during liquefaction. The attempts to remove phenolic groups from SPO using standard chemical procedures were unsuccessful. 2 refs., 12 tabs.

10616 **(ARC/CR—YCLQ-29) Batch autoclave tests for the liquefaction of Alberta subbituminous coals. Part 2. I.G. Farben and co-processing of coal with oil sands bitumen.** Moschopedis, S.E.; Hawkins, R.W.; Wasylyk, H. (Alberta Research Council, Edmonton (Canada). Coal Research Dept.). 1983. 38p. (CE—02147). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

The objectives of this report are to evaluate three Alberta subbituminous coals (Ardley, Judy Creek and Fox Creek) under optimum conditions established for the catalytic hydroliquefaction (I.G. Farben) and CO/steam processes using anthracene oil and bitumen as solvents. Batch autoclave tests were conducted in a stainless steel magnetically-stirred autoclave (1,000 cc), and standard work-up procedures were used. The data indicate small differences in the reactivity of the three coals. Using the I.G. Farben process, conversion rates ranged from 74 to 80% (anthracene oil solvent) and 73-84% (bitumen solvent). Using the CO/steam process with bitumen, conversion rates ranged from 81 to 87%. The CO/steam process gives higher yields of extracts but lower yields of distillable oils. The effects of hydrogen sulfide and temperature on the percent conversion and product distributions using bitumen as solvent to process coal were also studied. The results show the following. In the presence of H/sub 2/S, the yield of total liquids increased from 44% to 68%. By raising the temperature, an overall increase of the wt% of naphtha and volatile hydrocarbons occurred. At 415/sup 0/C, the weight of the naphtha, from co-processing coal with bitumen, increased by 10%, and the weight of volatile hydrocarbons increased by 2% over the blank. 5 refs., 4 figs., 16 tabs.

10617 **(ARC/CR—YCPY-6) Pyrolysis and hydropyrolysis of Alberta subbituminous coal using the heated screen apparatus.** Chambers, A.K.; Gangwal, S.K.; Royce, A.J. (Alberta Research Council, Edmonton (Canada). Coal Research Dept.). 1983. 48p. (CE—02156). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

An inductively heated screen reactor has been built and tested. Using a 10 mg sample, the unit allows the study of flash pyrolysis and hydropyrolysis of Alberta coals. Data is generated which is suitable for the derivation of kinetic constants for modelling of the devolatilization process. A measure of char, tar and gas yields is obtained along with an analysis of gases produced. The technique gives repeatability of char yield and mass balances between 80 and 90%. Pyrolysis yields agree with those produced on an atmospheric pressure entrained flow reactor of 5 g/h feed. Operation in helium and hydrogen atmospheres with Highvale coal has indicated that temperature increases overall conversion of products up to about 1000/sup 0/C. Pressure and residence time have minor effect on conversion under pyrolysis conditions, but may greatly increase yields in a hydrogen atmosphere. In hydrogen, pressure and residence time both favour higher yields with most of the increase in the form of methane. An unexplained scatter of overall conversion also appeared in hydropyrolysis runs at high pressure and long residence time. An accurate indication of screen and coal temperature cannot be obtained using a thermocouple larger than .01 inch sheath diameter. The .01 inch thermocouple may also give temperature errors during the sample heating period. An initial simple first order kinetic model has been developed for the pyrolysis of coal at atmospheric pressure. The mdoel allows for variation of the frequency factor and activation energy with temperature. A computer program for calculation of pyrolysis kinetics is included. 11 refs., 15 figs., 3 tabs.

10618 **(ARC/CR—YCPY-7) Evaluation of Alberta Plains coals for pyrolysis and liquefaction processes.** duPlessis, M.P. (Alberta Research Council, Edmonton (Canada). Coal Research Dept.). 1983. 60p. (CE—02142). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

Ten subbituminous coal specimens were selected for this investigation representing coal deposits of central Alberta. The study identified selective coal characteristics which showed trend-setting effects on the behavior of specimen coals to process reactions. Pyrolysis and solvolytic liquefaction reactions were studied as process variations. Pyrolysis behavior was determined by thermal gravimetric microassays coupled with detailed analysis of products from the Fischer-Schrader assay method. Liquefaction tests were conducted in stirred autoclaves. Empirical molecular weight of coal, fraction of carbon yielding volatile products, the oxidation state of the volatile carbon structure, mean reflectance of the vitrinite content, and the molecular fragment representing potential hydrocarbon source matter in solvolytic liquefaction were found to show trendsetting effects in pyrolysis and liquefaction reactions. It was seen that a fair amount of low boiling hydrocarbons could be obtained by pyrolysis, with mean average conversion to low temperature char at ca 72%, allowing ca 13.5 wt% coal to be converted to distillable oil and tar by-products. Though depositional history of coal formation influenced the solvolytic liquefaction behavior, each specimen showed some variation in the degree of conversion or in product distribution. The mean solvolytic conversion for all coals under various process modes was ca 84%. The variation in conversion data (79 to 95%) tends to reflect the ranking order in terms of reflectance, extent of deoxygenation reactions, and abundance of potential hydrocarbon source matter. 12 refs., 9 figs., 20 tabs.

10619 **(ARC/CR—YCPY-9) Coal utilization options for future energy and feedstock supplies.** du Plessis, M.P. (Alberta Research Council, Edmonton (Canada). Coal Research Dept.). 1984. 44p. (CONF-8406195—; CE—02154). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

From Annual technical meeting of the Petroleum Society of CIM; Calgary, Alberta, Canada (10 Jun 1984).

Interest in coal is based on its abundance and availability at relatively low cost, particularly in western Canada, where coals are used for power generation, and as source of fuel and feedstock for chemical and synfuels plants. This paper discusses special circumstances and innovative applications where coal could offer economic advantages. Specific cases which are examined include: beneficiation of bituminous and subbituminous coal by oil agglomeration to improve yields, quality, transportation costs and competitiveness of western coals in domestic and foreign markets; the co-generation of electricity, chemicals and synfuels using flash hydropyrolysis; and co-processing of coal, bitumen and natural gas, all abundantly available in Alberta at relatively low cost, to produce synthetic fuels using advanced process concepts for coal beneficiation and liquefaction. Results are presented of research conducted at the Alberta Research Council relating to these topics. Cost analysis from engineering studies are used to compare different technical advances and to serve as a guide for research and development needed to improve commercial feasibility. 7 refs., 12 figs., 8 tabs.

10620 **(AU/CE—8303) Hydroprocessing of coal-based liquids for removal of detrimental constituents: organic sulphur and nitrogen.** Dalla Lana, I.G.; Otto, F.D.; Al-Nuaimi, K.; Yeniova, H. (Alberta Univ., Edmonton (Canada). Dept. of Chemical Engineering). 1983. 63p. (CE—02163). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

Twenty-three runs to study the hydrodenitrogenation (HDN) of a feed consisting of quinoline blended into a heavy atmospheric gas oil (HAGO) have been completed using a stirred catalyst basket reactor. Variables studied include: feed nitrogen concentration, temperature, pressure, catalyst, Ni-Mo or Ni-W, oil/catalyst ratio, oil/hydrogen ratio, and stirring rate. In addition, two runs were made to study the hydroprocessing of a coal liquid. In general, the rate of conversion increases with increasing temperature, decreasing oil/catalyst ratio and increasing nitrogen content of the feed. Conversion is independent of stirring rate at rates above 800 rpm and appears to be independent of hydrogen pressure for pressures in the range 13.9 to 17.3 megapascals. The Ni-Mo catalyst is more effective than the Ni-W catalyst for the HDN of quinoline blended HAGO. However, The catalysts were equally effective for the HDN of the coal liquid. Reaction rate constants for denitrogenation based on a simple first order rate expression have been derived. The activation energy for these constants varies from 100 to

130 kJ/mole. Hydrogen consumption increases with an increase in the amount of nitrogen converted and is in the range 175 to 200 m/sup 3/ (API)/m/sup 3/ for the HDN of quinoline/HAGO feeds to nitrogen conversions ranging from about 60% to 88%. The processing of the coal liquid required a hydrogen consumption of about 260 m/sup 3/ (API)/m/sup 3/ to achieve a nitrogen conversion of 69%. 11 figs., 11 tabs.

10621 **(CMRC—02170) [Coal] Liquefaction and pyrolysis. Fourth quarter progress report, January 1, 1982 - March 31, 1982.** duPlessis, M.P. (Coal Mining Research Centre, Edmonton, Alberta (Canada)). 1982. 32p. (CE—02170). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

In an Alberta coal liquefaction research program, batch autoclave tests were conducted to evaluate subbituminous coals over a wide range of process conditions representative of known liquefaction processes. The results enable relative ranking of coals and give an initial indication of process conditions best suited to different Alberta regions. Results obtained to date indicate significant differences in reactivity among the three reference coals. Significant findings are the relatively high conversions achieved with the dispersed catalyst, CO/steam and coal-bitumen process conditions even with the least reactive of the three coals. Lower conversions were obtained with a process using rapid heating and short residence time. A related program on coal pyrolysis is also being set up but activities were shut down temporarily during the period covered by this report. Additional liquefaction related activities included investigation of slurry viscosities, surface properties of coal char and catalysts, thermogravimetric analysis of char and coal reactivities, and petrographic analysis of coal and liquefaction residues. Supporting activities continued on the development of analytic methods for class analysis of coal-derived liquids, simulated distillation by gas chromatogaphy and characterization of coal liquid components. Collaborative research with other agencies is also outlined. 13 refs., 8 tabs.

10622 **(CONF-880488—7) Corrosion behavior of chromized and/or aluminized Cr-Mo steels in medium-Btu coal-gasifier environments.** Wang, D. (Argonne National Lab., IL (USA)). Apr 1988. Contract W-31109-ENG-38. 36p. NTIS, PC A03 - OSTI. Order Number DE89003942/JAW.

From 15. international conference on metallurgical coatings; San Diego, CA, United States (11 Apr 1988).

Cr-Mo steels are widely used in constructing the metallic components of conventional coal gasifiers because of their desirable mechanical strength and corrosion resistance at temperatures below 350{degree}C. For higher temperature applications, e.g., 600{degree}C, additional surface treatments such as diffusion coatings are required to provide sufficient corrosion resistance. The corrosion behavior of the 2 1/4Cr-1Mo and 9Cr-1Mo steels with various coatings were investigated in this study. The aluminized coatings were found not suitable for use in coal-gasifier atmospheres due to severe cracking and internal sulfidation/oxidation. Chromized coatings with >30 wt % Cr and a coating thickness of 100-μm provided acceptable corrosion resistance for the 2 1/4Cr-1Mo steel, however, further improvement in scale adherence is essential for long-term service. The sulfidation of base metal constituents at the coating surface and internal oxidation/sulfidation degraded the chrome-aluminized 2 1/4Cr-1Mo steel and breakaway corrosion occurred. 16 refs., 15 figs., 1 tab.

10623 **(DOE/PC/50802—T2) Gasification reactivities of coal and coal-char: Final report.** O'Brien, W.S. (Southern Illinois Univ., Carbondale (USA). Dept. of Mechanical Engineering and Energy Processes). 16 Sep 1988. Contract FG22-82PC50802. 299p. NTIS, PC A13/MF A01 - OSTI; 1; GPO Dep. Order Number DE89002476/JAW.

The overall project involves five separate studies examining the reaction behavior of typical Illinois basin high-volatile C bituminous coals when these coals are exposed to three different devolatilization/pyrolysis reaction situations and also when undergoing a gasification reaction in oxygen-steam environment. This study also discusses the devolatilization of Illinois coal particles flowing in nitrogen through a laminar-flow reactor are 450{degree}, 600{degree} and 800{degree}C and also describes the behavior of coal during pyrolysis in a crucible inserted in an upright tube furnace at different temperatures and for different time periods. An Illinois coal was reacted in a basket-type solids-holder suspended in an upward flowing nitrogen stream. The heatup time in this system would be slightly less than the heatup rate of the coal carbonized in a crucible-reactor system. This same basket-type reactor was used in earlier study to investigate the gasification of an Illinois coal and a coal-char in a steam-oxygen atmosphere. A second portion of this study was involved with the analyses of the inorganic element composition of four Illinois coals. As an overall project, the combined results of these studies demonstrated the significant effects of reactor system design on the devolatilization/pyrolysis reaction rates of softening coals such as those found in the Illinois coal basin. 113 refs., 73 figs., 29 tabs.

10624 **(DOE/PC/79933—T3) Effectiveness factors for hydroprocessing of coal and coal liquids: Progress report No. 4 for the period June 15, 1988--September 14, 1988.** Massoth, F.E.; Seader, J.D. (Utah Univ., Salt Lake City (USA). Dept. of Fuels Engineering). 30 Sep 1988. Contract FG22-87PC79933. 9p. NTIS, PC A02/MF A01 - OSTI. Order Number DE89003307/JAW.

The aim of this research project is to develop a methodology to predict, from a knowledge of feed and catalyst properties, effectiveness factors for catalytic hydroprocessing of coal and coal liquids. To achieve this aim, it is necessary to account for restrictive diffusion, which has not hitherto been done from a fundamental approach under reaction conditions. The research proposed here entails a study of hydrodenitrogenation of model compounds and coal-derived liquids using three NiMo/alumina catalysts of different pore size to develop, for restrictive diffusion, a relationship that can be used for estimating reliable effectiveness factors. During this period: (1) a further attempt was made to produce catalyst particles with uniform distribution of nickel and molybdenum; (2) larger batch samples of catalysts were prepared from the alumina supports previously obtained and their properties were measured; (3) room temperature diffusion studies were started; and (4) a long-term flow-reactor test was made. 1 ref., 2 figs.

10625 **(DOE/PC/80531—T10) An isothermal kinetic study of the intermediate states in coal pyrolysis: Final report.** Miknis, F.P. (Western Research Inst., Laramie, WY (USA)). Sep 1988. Contract FG22-85PC80531. 60p. NTIS, PC A04/MF A01 - OSTI; 1; GPO Dep. Order Number DE88017319/JAW.

Isothermal pyrolysis experiments were conducted at 375{degree}, 400{degree}, and 425{degree}C on Illinois No. 6 high volatile bituminous and on Wyodak subbituminous coal samples. Pyrolysis studies were conducted on nominally 10- to 20-gram samples using a fluidized sand-bath reactor system. A helium sweep gas flow rate of 30 cc/min was used to remove the products from the reaction zone. The amount of coal converted to tar, gas, and residue was determined for different reaction durations at each temperature. Elemental analyses (CHN and S) were obtained on the solid and liquid reaction products using standard instrumental techniques. Solid- and liquid-state ^{13}C NMR techniques were used to characterize the residue coal and tars produced during varying stages of pyrolysis. The residue coal from each isothermal pyrolysis experiment was extracted with chloroform to obtain information about the chloroform soluble intermediates. Only small amounts of material were extractable with chloroform at any stage of pyrolysis for either coal. The distributed activation energy model was used to calculate activation energies for hydrocarbon gas evolution. Activation energies for individual hydrocarbon gas species were comparable for both coals, and were in the range of 48 to 56 kcal/mol. 35 refs., 18 figs., 4 tabs.

10626 **(DOE/PC/80536—T7) A new method of magnetic characterization of zeolite-cobalt catalysts: Final technical report.** Murty, A.N. (Grambling State Univ., LA (USA)). 31 Aug 1988. Contract FG22-85PC80536. 76p. NTIS, PC A04/MF A01 - OSTI; 1; GPO Dep. Order Number DE89002084/JAW.

The general objective of this project is to make a comprehensive study of the nature of the transition metal cobalt in the bifunctional zeolite catalyst Co-ZSM-5 using zero field nuclear magnetic resonance techniques. In particular, this study was undertaken to elucidate the magnetic character of cobalt as related to: the method of impregnation; the presence of promoters; the crystalline nature of the cobalt particles; the concentration of cobalt in the catalyst, and degree of dispersion and reduction; and the pre-conditioning and use as catalyst for the conversion of syngas. The complete details are presented in the following pages. 17 refs., 28 figs., 20 tabs.

10627 **(DOE/PC/80912—T9) Development and applications of new air-stable liquid clathrates.** Means, C.M. (Alabama Univ., University (USA)). 1988. Contract FG22-85PC80912. 101p. NTIS, PC A06 - OSTI. Order Number DE89003341/JAW.

The objective of this work was the development of L.C.'s based on other systems less reactive to oxygen and water than the aluminum alkyls. (Trimethylaluminum ignited upon exposure to air and explodes violently when contacted with water.) The ultimate goal was the development of an air and water stable L.C. This has been accomplished. Justification of these objectives results directly from possible L.C. applications. Industry is somewhat hesitant to utilize a process that incorporates materials that are hazardous or difficult to handle. Applications studied in this work include hydrocarbon separations in L.C.'s and catalyst incorporation within L.C.'s. Several of the new L.C.'s have proved to be applicable in ambient condition coal liquefaction. 47 refs., 21 figs., 21 tabs.

10628 **(DOE/PC/90538—9) Use of basic nitrogen to chemically clean coal: Quarterly report No. 7 for the period September 15, 1988 to December 15, 1988.** Silver, H.F. (Wyoming Univ., Laramie (USA). Dept. of Chemical Engineering). 15 Dec 1988. Contract FG22-86PC90538. 9p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004405/JAW.

Studies of the effect of the concentration of basic nitrogen compounds in coal derived distillates as solvents on coal desulfurization were continued. Mild coal liquefaction runs were made using a solvent consisting of 25 wt % 4-di-methylaminopyridine (DMAP) and 25 wt % 5-amino-1-naphthol (AN) in a coal derived distillate. A comparison has been made of the results obtained from these runs and from earlier runs in which coal derived distillate of 5 wt % DMAP or AN in distillate was used as the solvent. Under comparable reaction conditions, both DMAP and AN showed little if any positive effect on the desulfurization of the coal. DMAP appears to have a small but positive effect on the conversion of lignite and subbituminous coal to pyridine soluble product. However, the AN appears to have a definite negative effect on pyridine conversion for all cases studied. 4 tabs.

10629 **(E/ECE—9003099) Production of gaseous fuels from brown coal.** (United Nations, Geneva (Switzerland). Economic Commission for Europe). 12 May 1988. 4p. United Nations Economic Commission for Europe, Palais des Nations 1211, Geneva 10, Switzerland. Order Number TI89003099/JAW.

From the geological point of view Czechoslovakia is a very interesting country, and it is exceptional in that comparatively large reserves of fossil fuels, from high-quality hard coal to the youngest form of brown coal and lignite, are concentrated in a relatively small area. For this reason the industrial use of coal for various purposes has been traditional for many years. This paper briefly discusses the gasification of brown coal and production of town gas.

10630 **(MISC—88132) Biological processing and interactions with coal: Summary of activities for the period April 1, 1988--June 30, 1988.** (EG and G Idaho, Inc., Idaho Falls (USA)). 1988. Contract AC07-76ID01570. 8p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004944/JAW.

Biodegradation/solubilization of coal and organic sulfur is described. The effects of chloramphenicol, an inhibitor of protein synthesis, on dibenzothiophene degradation by the bacterial isolate STONF was continued. 4 figs., 2 tabs. (CBS)

10631 **(MISC—88133) Biological processing and interactions with coal: Summary of activities for the period January 1, 1988--March 31, 1988.** (EG and G Idaho, Inc., Idaho Falls (USA)). 1988. Contract AC07-76ID01570. 10p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004945/JAW.

Biodegradation/solubilization of coal is described. The degradation of dibenzothiophene by two bacterial strains is reported. The effects of adding salicylate to the treatments was also investigated. 2 figs., 5 tabs. (CBS)

10632 **(NEI-FI—47) Technique of the desulphurisation of fuel gases. Collaboration between Finland and the SU.** Rautanen, K. (Cleanair Oy, Kaarina (Finland)). May 1988. 80p. (In Finnish). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88755809/JAW.

This research continues the former preliminary, which examined the possibilities of collaboration between Finland and the SU in the technique of the desulphurisation of fuel gases. As to the goals, determined in the preliminary research, research-collaboration has already been started in questions dealing with the treatment of lime. A Finnish-Soviet specialist-meeting was held in Leningrad in March 1988 dealing with gasification of solid fuel and gas purification, relating to it. On the basis if this meeting the Soviet and the Finnish organizations (which were participants) have decided to make the goals and the forms of the collaboration more precise. The report will cover the followinn subjects: the starting of the collaboration and its hindrances, the environmental politics of the SU, a look at the technique of diminishing sulphur emissions in the SU, interesting subjects for collaboration, recommendations and suggestions.

10633 **(STU-I—670-1988) Cocurrent gasification. Reactor construction.** Asplund, F. (Scandiakonsult, Stockholm (SE)). (Swedish National Board for Technical Development, Stockholm). Mar 1988. 66p. (In Swedish). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88755909/JAW.

A cocurrent gasification reactor was constructed and tested in full scale, and a simple computer model was developed of the reactor process and for dimensioning the reactor. The gasification reactor was designed according to the following criteria: Optimum process data, Automatic operation, A large regulating range (better than 1:10), Low demands on fuel quality, High availability, Simple design, and Low demands on materials. The mathematical model is much simplified in the treatment of the kinetics, partly due to the difficulties of obtaining realistic fuel parameters. (L.E.).

0105 By-products

REFER ALSO TO CITATION(S) 11500

0106 Properties

REFER ALSO TO CITATION(S) 10623, 10649, 10671, 10678, 10680, 10741, 11468

10634 **(ARC/CR—YCLQ-20) Contribution of vitrinite macerals to the liquefaction of subbituminous coals.** Parkash, S.; Lali, K.; Holuszko, M.; du Plessis, M.P. (Alberta Research Council, Edmonton (Canada). Coal Research Dept.). 1983. 23p. (CE—02153). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

Four Alberta subbituminous coals were selected to investigate the contribution of vitrinite macerals to liquefaction. There are indications of a rectilinear correlation between conversion yields of different density fractions of coal and their vitrinite contents, but it is too early to discern any converison factor by which any maceral group may be used to predict the liquefaction behaviour of a subbituminous coal. Contrary to common belief, not all the vitrinite fraction of the feed coal is reactive. There seems to be a definite positive correlation between the percent vitrinite reacted and the lique-

faction conversion yield. Petrographic analysis of residues obtained from liuqefaction experiments supports the idea that the behaviour of vitrinite macerals is influenced by the degree of fusinization and gelification of the original plant material. However, it is difficult at this stage to evaluate with confidence the liquefaction behavior of a particular coal by means of a comparative study of maceral composition before and after liquefaction. 12 refs., 3 figs., 8 tabs.

10635 **(ARC/CR—YCLQ-23) Simulated microdistillation of coal-derived liquids by thermogravimetry.** Iacchelli, A.; Selucky, M. (Alberta Research Council, Edmonton (Canada). Coal Research Dept.). 1983. 19p. (CE—02167). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

Boiling point distribution range is one of the parameters to define the properties of a liquid mixture. To use this parameter in process quality control, a suitable rapid method of analytical or simulated distillation of micro-quantity sample is needed. Thermogravimetry (TGA) is capable of separating liquid samples by boiling point, and, with proper experimentation, can be used to simulate distillation. The physics of distillation is based on the equilibrium condition between the gaseous and the liquid phase, which is hard to achieve in TGA. This report explores various experimental conditions to satisfy this demand on phase equilibria. The study, which is exploratory in nature and based on three samples of known boiling point distribution, provides some understanding of the influence of variable heating rate, purge gas flow rate, sample size and sample vessel design, and forms the basis of further development work. 2 refs., 5 figs., 6 tabs.

10636 **(ARC/CR—YCLQ-24) Proximate analysis of coal and solid products from coal conversion by thermogravimetric analysis.** Iacchelli, A.; Selucky, M. (Alberta Research Council, Edmonton (Canada). Coal Research Dept.). 1983. 29p. (CE—02164). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

Proximate analysis of coals consists of the determination of moisture, volatile matter, ash and fixed carbon in a sample. This report shows that this analysis can be accomplished using thermal gravimetric analysis (TGA) as a procedure which can simulate all conditions involved. The influence of various variables, such as sample size, purge gas flow rate, temperature program and coal rank have been studied using coal samples ranging in rank from low volatile bituminous coals to lignites. The TGA procedure practically eliminates sample contact with ambient air and reduces sample handling to detemining (automatically) its original weight before the start of the analysis. The whole proximate analysis is essentially a one-step procedure. The use of oxygen after volatile matter removal allows direct burning of fixed carbon as a direct determination of its weight. The method is fast and well repeatable and is recommended as a semiroutine procedure, especially for very small samples from minibomb experiments, or where additional information on the course of sample devolatilization is of interest, such as in the analysis of pyridine and toluene extracts and the various insoluble materials form coal conversion experiments. 7 refs., 13 figs., 4 tabs.

10637 **(ARC/CR—YCLQ-30) Novel baseline treatment in simulated distillation by gas chromatography. Final report.** Southern, T.G.; Cuthiell, D.; Selucky, M.L. (Alberta Research Council, Edmonton (Canada). Coal Research Dept.). 1983. 28p. (CE—02159). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

The major problem associated with the simulated distillation of medium oils by gas chromatography is that of removing the effects of the instrument baseline. Although currently two techniques exist to overcome this problem, neither of them manages to eliminate the effects efficiently for the high temperature region of the chromatogram. In this paper a new approach to this problem is developed which, within experimental error, overcomes the drawbacks of the now-established methods. The method is based on a mathematical model which uses the instrument column temperature as the independent variable. This new method, however, requires that the baseline be defined at at least 2 points during the experimental run and that the position of these two points be repeatable from sample to sample. 12 figs., 4 tabs.

10638 **(ARC/CR—YCLQ-31) Correction tables for the conversion of boiling points measured at reduced pressures to their atmospheric equivalent boiling points.** Southern, T; Grochowski, W.; Selucky, M.L. (Alberta Research Council, Edmonton (Canada). Coal Research Dept.). 1983. 80p. (CE—02152). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

Distillation at ambient pressure in the laboratory is limited to a temperature range up to approximately 300/sup 0/C, while all higher boiling materials have to be distilled under reduced pressures. In order to have a homogeneous boiling point (BP) scale, it is necessary to convert BPs obtained at reduced pressure to corresponding atmospheric pressure boiling points. Tables are presented giving correction factors used in determining such boiling points. The data in these tables are based on the Maxwell-Bonnell correlation (1951), together with corrections based on temperature differences between the normal BPs predicted from the graph prepared by Maxwell and Bonnell and from data measured at 5 and 0.5 mm. The final form of the correction term is $T = -2.5(K - 12.0) \times \log(P/sub\ 2//P/sub\ 1/)$ where P/sub 2/ and P/sub 1/ are the upper and lower vapor pressure limits for the interval in question and K is a constant that depends on the component in question. BP values are given in 5/sup 0/C increments for pressures ranging from 0.1 to 750 mm Hg. Another set of tables gives correction factors for K values ranging from 0.5 to 20.6 over the same pressure ranges. Nominally, the K values for hydrocarbons will range between 8 and 14. 6 refs., 4 tabs.

10639 **(ARC/CR—YCPY-10) Nature of porosity in Alberta subbituminous coals.** Parkash, S.; Lali, K.; Holuszko, M. (Alberta Research Council, Edmonton (Canada). Coal Research Dept.). 1984. 50p. (CE—02160). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

The nature of porosity in subbituminous coals was studied using different characterization techniques, namely, gas adsorption, helium and mercury displacement, and mercury porosimetry. The 11 coal samples tested fairly represent the full range of geographic rank and geological variations present in the Alberta Plains coal region. Surface areas calculated from CO/sub 2/ adsorption are consistently higher than those calculated from nitrogen. There is no defined influence of the geographic location or rank of the coals on their surface areas. The narrow range of the carbon content in the tested coals does not permit determination of the influence of this parameter on surface area and porosity. CO/sub 2/ surface area is essentially not very dependent on the particle size in the 40-550 micron range; however, the nitrogen surface areas tend to increase with decreasing particle size. Removal of inorganic matter from coals brings about a reduction in surface area. For subbituminous coals, the methanol densities are invariably higher and n-hexane densities are lower than the corresponding helium densities. The mercury density values vary between 1.106 and 1.316 g/cm/sup 3/. Toal pore volumes have been measured in the 1.2-3000 nm range; almost all the surface area in coals is located in micropores (< 2 nm). Coals vary widely in total pore volumes. The porosities range from 9.5-22.3%. Percent pore volume contained in micropores varies from 29.5-75.9%. In most of the coals tested, pore volume distribution is bimodal, showing 2 peaks in the diameter range 2-5 nm and 7-10 nm respectively. 34 refs., 13 figs., 13 tabs.

10640 **(CMRC—80/10-T) Evaluation of beneficiation potential of thermal coals.** Tucker, P.V.; Butcher, S.G. (Coal Mining Research Centre, Edmonton, Alberta (Canada); Simon-Carves of Canada Ltd., Willowdale, Ontario). 1980. 22p. (CONF-8002111—; CE—02176). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

From 1. CIM technical meeting on western Canadian coals; Vancouver, Canada (14 Feb 1980).

The value of a coal for the thermal generation market depends primarily on its calorific value, but beneficiating the raw coal to achieve the desired calorific value results in some loss of heating value to discard. This paper sets out in a new format the relationships between product calorific value, ash content, moisture content and yield. This format enables the beneficiation potential of various coals to be compared, and use of the format is demonstrated for three widely different western Canadian coals. The first advantage claimed for the format is that appreciation of the data does not require the familiarity with coal preparation technology called for by classical washability curves. Secondly, the cost benefits of alternative coal preparation schemes can be determined, subject to a minimum of variables. Brief consideration is given to some practical methods of obtaining the necessary raw coal data. 9 refs., 4 figs., 5 tabs.

10641 **(CONF-880604—14) Kinetics of vacuum drying and rehydration of Illinois No. 6 coal samples: Implications for pore structure.** Vorres, K.S.; Kolman, R.; Griswold, T. (Argonne National Lab., IL (USA)). 1988. Contract W-31109-ENG-38. 10p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004206/JAW.

From Joint meeting of the 195th national meeting of the American Chemical Society and the 3rd Chemical Congress of North America; Toronto, Canada (5 Jun 1988).

The kinetics of vacuum dehydration and rehydration in nitrogen near room temperature have been studied with Argonne Premium Coal Samples. A block, {minus}20 mesh and {minus}100 mesh material were used. Three types of kinetic behavior were observed in dehydration and rehydration. These included a first order mass change, a combination of some or all of an initial linear, parabolic and final linear (LPL) segments, and a behavior which can be plotted to appear similar to an adsorption isotherm. The mechanisms involved in the linear-parabolic-linear sequence are tentatively assumed to be loss from macro pores, bulk diffusion, and loss of "bonded water," respectively. The rates are higher for dehydration in vacuum than for rehydration in nitrogen. The rates increase as the external surface increases from the block through the {minus}20 mesh to the {minus}100 mesh material. 2 refs., 6 figs.

10642 **(NEI-FI—55) Self-heating tendency and self-ignition of peat.** Tummavuori, J.; Eira, T. (Jyvaeskylaen yliopiston kemian laitos, Jyvaeskylae (Finland)). (Kauppa-ja Teollisuusministerio, Helsinki (Finland). Energiaosasto). 1986. 76p. (In Finnish). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88755816/JAW.

The self-heating tendency and self-ignition of peat in a stockpile is a phenomen which has been known for several years. The problem can be approached from two points: by studying the mechanism of exothermic reactions and, by developing the stockpiling techniques. In this work, we have applied infra-red spectroscopy to the problem solving. The power of infra-red spectroscopy is based on the absorptions caused by the characteristic vibrations of different chemical bonds providing information of the chemical nature and structure of peat. The absorptions also are quantitative, which is a necessary feature for this study. The principal idea was to determine the quantitative portions of acids and carbohydrates appearing at wavenumbers 1620 cm and 1060 cm, respectively. The relationship of these groups was calculated as follows: K = (A/sub 1620/ cm/sup -1/ - A/sub 1060/ cm/sup -1/)/560, where A/sub 1/ = absorbance at wavenumber i, K = self-heating parameter. The self-heating parameter gives information to following questions: The self-heating tendency of peat can be unambiguosly explained. If the value of K is equal or more than 0.25, peat is not subject to self-heating. If K < 0.25, it gives indication for good quality sod peat. If K is 0.20-0.24, the quality is fairly good and if K is more than 0.25, the quality of sods will be poor. Even a small amount of self-heated peat may damage a large amount of horticultural peat. When peat is heating, the amount of easily protolyzable protons is increased. This will lower the pH and increase the electric conductivity of the substrate too high, which will prevent the nutrient supply. Tropical peats differ significantly from peats of other regions. This can be demonstrated by analyzing infra-red spectra of those peats. The resolution of infra-red spectroscopy is sufficient to characterize tropical peats.

10643 **(PNL-SA—16341) Biodegradation of air-oxidized Illinois No. 6 coal.** Linehan, J.C.; Fredrickson, J.K.; Wilson, B.W.; Bean, R.M.; Stewart, D.L.; Thomas, B.L.; Campbell, J.A.; Franz, J.A. (Pacific Northwest Lab., Richland, WA (USA)). Sep 1988. Contract AC06-76RL01830. 15p. (CONF-8809188—1). NTIS, PC A03/MF A01 - OSTI. Order Number DE89002372/JAW.

From Workshop on coal biodegradation; Tyson's Corners, VA, USA (25 Sep 1988).

We have found that Illinois No. 6 coal, after an air-oxidation pretreatment, can be substantially biodegraded by Penicillium sp. to a product largely soluble in dilute base. It is the purpose of this paper to describe the chemical nature of the biotreated Illinois No. 6 coal and to compare it with the corresponding material from leonardite biosolubilization. 12 refs., 7 figs., 3 tabs.

10644 **(VTT-TIED—835) Properties of pulverized peat as fuel.** Nissinen, K.; Huotari, J. (Valtion Teknillinen Tutkimuskeskus, Jyvaeskylae (Finland). Kotimaisten Polttoaineiden Lab.). (Valtion Teknillinen Tutkimuskeskus, Espoo (Finland)). Feb 1988. 75p. (In Finnish). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88755927/JAW.

As a main object of the research the utilization technics of centralized produced pulverized peat was to be developed. The emphasis was in experimental research aiming at the result of a preliminary plant concept for district heating and industry purposes.

0108 Waste Management

REFER ALSO TO CITATION(S) 10674, 10897, 10970, 10973, 11270

10645 **(AU/CE—8303) Coal conversion wastewater technology.** Hrudey, S.E.; Fedorak, P.M. (Alberta Univ., Edmonton (Canada). Dept. of Civil Engineering). 1983. 42p. (CE—02162). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

A serum bottle technique has been developed and used to study the anaerobic degradation of various phenolic substrates relevant to coal conversion wastewaters. Previous work indicating that only phenol and p-cresol are readily fermented to methane has been confirmed along with the evidence of highly selective removal of these substrate mixtures. A quantitative method for measuring absolute quantities of methane produced has been refined and applied to draw and feed cultures maintained on phenol and p-cresol. Ultimate production stoichiometry from batch cultures has been measured and applied to draw and feed experiments to provide a valuable basis for predicting methane generation potential for these substrates. Oxidative pretreatment studies with peroxide and ozone have demonstrated that such schemes do not offer useful application prior to anaerobic processes. Evaluation of alternate sources of anaerobic sources of anaerobic bacteria has not yet provided phenolic degradation potential beyond that available from the municipal digester sludge being used. Although mixed cultures of anaerobic bacteria have been sustained in draw and feed culture for over 15 months with phenol as sole carbon source, it has not been possible to isolate the phenol degraders in pure culture. 3 refs., 12 refs., 3 tabs.

10646 **(CONF-880326—2) Sorbent life cycle testing fluidized-bed copper oxide process.** Shah, P.P.; Leshock, D.G. (UOP, Inc., Des Plaines, IL (USA)). 1988. Contract AC22-85PC81004. 18p. NTIS, PC A03/MF A01 - OSTI. Order Number TI89003881/JAW.

From 4. integrated environmental control symposium; Washington, DC, USA (2 Mar 1988).

The Fluidized-Bed Copper Oxide process is a promising new technology being developed to simultaneously remove sulfur dioxide and nitrogen oxide contaminants from the flue gas of coal-fired utility boilers. This dry and regenerable process uses a copper oxide sorbent in a fluidized-bed reactor. Contaminants are removed in a relatively simple fashion without generating waste material. The Pittsburgh Energy Technology Center (PETC) of the US Department of Energy has demonstrated the technical and economic po-

tential of the Fluidized-Bed Copper Oxide process through several stages of bench and pilot plant testing. UOP Inc. has continued this effort in a testing program completed with a 100 SCFM Life-Cycle Test unit. During this testing, UOP "confirmed" that the process is capable of simultaneously removing 90 vol % of the sulfur dioxide and nitrogen oxide contaminants from coal-derived flue gas. 7 refs., 8 figs., 1 tab.

10647 **(CONF-881036—2) Simultaneous removal of SO_2/NO/sub x/ in a laboratory spray-dryer system.** Huang, Hann S.; Gorski, A.J.; Harkness, J.B.L.; Livengood, C.D.; Farber, P.S.; Morris, R.A. (Argonne National Lab., IL (USA)). Oct 1988. Contract W-31109-ENG-38. 18p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004268/JAW.

From APCA specialty conference on environmental challenges in energy utilization during the 90's; Cleveland, OH, USA (10 Oct 1988).

A laboratory spray-dryer system was constructed to study the effects of process modifications on the simultaneous removal of sulfur dioxide and nitrogen oxides from simulated flue gases typical of coal firing. Parametric tests of five chemical additives (sodium hydroxide, sodium bisulfite, sodium chloride, calcium chloride, and calcium lignosulfonate) at three spray dryer outlet temperatures (65, 80, and 95{degree}C) have been completed to date. The first four compounds were added at an amount equivalent to 10 mol % (based on calcium hydroxide), and the lignosulfonate was added at 1.5 wt % (based on calcium hydroxide). The overall reagent/sulfur molar ratio was maintained at 1.2 throughout the experiments. Sodium chloride at all temperatures and calcium chloride at 65{degree}C significantly enhanced NO/NO/sub x/ removal inside the spray dryer. Sodium chloride, calcium chloride, and sodium bisulfite significantly improved SO_2 removal at up to 80{degree}C. Increasing the spray-dryer outlet temperature from 80{degree}C to about 90{degree}C significantly increased the NO/NO/sub x/ removal by calcium hydroxide alone, but had little effect on NO/NO/sub x/ removal with the additives. With the exception of sodium chloride, the enhanced removal in the presence of additives diminished at high temperature. In comparison, the absolute level of SO_2 removal and the amount of improvement over baseline values decreased significantly with increasing temperature. The mechanism for SO_2 removal inside a spray dryer is reasonably well understood, but the NO/NO/sub x/ removal is poorly understood, and appears to be extremely complicated. 10 refs., 8 figs., 1 tab.

10648 **(DOE/PC/80515—T2) Surface science model studies for flue gas cleanup processes: Final report, September 1, 1985--August 31, 1988.** (Maine Univ., Orono (USA)). [1988]. Contract FG22-85PC80515. 3p. NTIS, PC A02/MF A01 - OSTI. Order Number DE89004331/JAW.

In this project an apparatus to perform in situ x-ray photoelectron spectroscopy at pressures up to {approximately}1 mbar was set up and calibrated. This equipment was subsequently used to study the interaction of SO_2 and SO_2/O_2 gas mixtures with single crystalline and polycrystalline copper and copperoxide surfaces and polycrystalline ironoxide surfaces. The aim of the study was to identify the sulfur containing surface species present as a function of partial pressures and temperature and to study the kinetics of sulfur dioxide interaction with the substrates. Whereas we were successful to identify surface species under stationary pressures and temperature conditions, the limited pumping characteristics and thermal response of the samples prevented the determination of detailed kinetic parameters of the reaction. However, the results obtained on bulk copper and copperoxide surfaces reveal that under the partial pressure conditions of our experiments a sulfoxide surface species is only stable around room temperature and decomposes into coppersulfide upon heating to 350 K. In the following we summarize the major results of our studies.

10649 **(EPRI-CS—3612-Vol.2-Rev.1) FGD chemistry and analytical methods handbook: Volume 2, Chemical and physical test methods: Revision 1: Final report.** (Electric Power Research Inst., Palo Alto, CA (USA); Radian Corp., Austin, TX (USA)). Nov 1988. 1348p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI89004101/JAW.

The purpose of this handbook is to provide a comprehensive guide to sampling, analytical, and physical test methods essential to the operation, maintenance, and understanding of flue gas desulfurization (FGD) system chemistry. EPRI sponsored the first edition of this three-volume report in response to the needs of electric utility personnel responsible for establishing and operating commercial FGD analytical laboratories. The second, revised editions of Volumes 1 and 2 were prompted by the results of research into various non-standard aspects of FGD system chemistry. Volume 1 of the handbook explains FGD system chemistry in the detail necessary to understand how the processes operate and how process performance indicators can be used to optimize system operation. Volume 2 includes 63 physical-testing and chemical-analysis methods for reagents, slurries, and solids and information on the applicability of individual methods to specific FGD systems. Volume 3 contains instructions for an FGD solution chemistry computer program designed by EPRI as FGDLIQEQ. Executable on IBM-compatible personal computers, this program calculates the concentrations (activities) of chemical species (ions) in scrubber liquor and can calculate driving forces for important chemical reactions such as SO_2 absorption and calcium sulfite and surface precipitation. This program and selected chemical analyses will help an FGD system operator optimize system performance, prevent many potential process problems, and define solutions to existing problems.

10650 **(NEI-DK—101) Desulfurization, in connection with coal-firing, using quick-lime and powdered dry slaked lime injection.** Wismann, T. (DK-Teknik, Soeborg (Denmark)). 1988. 44p. (In Danish). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755784/JAW.

On a 5 MW Danstoker Tagus grate fired boiler, 10 tests have been carried out with injection of quick-lime and powdered dry slaked lime to reduce the emission of sulphur dioxide. The lime was injected together with the secondary air, and through an opening in the boiler front. The stoichiometric lime/sulphur ratio varied between 1:1 and 3:1. A reduction of the emitted sulphur dioxide of between 11% and 43% was obtained. The highest separation was found by adding calcium hydroxide to the secondary air. By the Ca/S ratio 3 the reduction was thus 43%. Dosed in the same way and in the same surplus, quick-lime gave only half as big a reduction. By a stoichiometry of 3 and a separation of 43%, 15 kgs of desulphurization products per kg sulphur removed result, 15% of the added calcium is utilized. The waste product contains a considerable amount of unreacted lime. The cost of using lime is 4% higher than that of using coal. Whether long time operation with the addition of lime will eventually foul the boiler heating surfaces, resulting in deteriorated boiler efficiency and an increase in fuel expenses has not been investigated. (AB).

10651 **(NEI-DK—103) Sulfur dioxide linkage to dry limestone fuels and combustion techniques.** Dam-Johansen, K.; Oestergaard, K. (Danmarks Tekniske Hoejskole, Lyngby. Inst. for Kemiindustri). Aug 1988. 18p. (In Danish). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755786/JAW.

The reaction between sulphur dioxide and lime stone particles within the temperature range of 500 - 975 deg. C was examined in three reactor systems: - An electrically heated recycle reactor. - An electrically heated laboratory fluidized bed reactor. - A coal fired, pilot plant sized fluidized bed combustor. The evaluation of 23 primarily locally available limestones as desulphurization agents shows that they fall into three groups. The most reactive types are chalks of a porous, fine grained texture and of a relatively young geological age. The types with the lowest reactivity are geologically old, crystalline calcites of very low porosity. Types of intermediate reactivity are soft limestones of a porous, coarse grained texture. The effect of particle size, gas composition and temperature on the rate of reaction and the extent of desulphurization was studied. During sulphation of a local chalk and limestone in the reactors a weak negative correlation between the sulphur capacity and the particle size was noted. This was not the case during pilot plant experiments, probably because of elutriation. The reaction between SO2 and CaCO3 at 600 deg. C appears to be influenced by concentrations of O2 and CO2. Around 850 deg. C a first order relation between the initial rate of sulphation and the concentration of SO2 was observed. For the local stones the final extent of sulphation

was nearly unaffected by the concentration of SO2. Pore size distribution was determined by mercury penetration in the local chalk and limestone. In the raw materials the pore size distribution appears to be fairly narrow. During calcination a micropore structure was developed in the grains. The micropores were blocked during sulphation. Particle cross sections of the chalk were examined in a scanning electron mixroscope by energy dispersive X-ray analysis. Sulphation profiles were calculated on this basis. (AB).

10652 **(NEI-DK—123) Sulfur dioxide linkage to dry limestone fuels and combustion techniques.** Dam-Johansen, K. (Danmarks Tekniske Hoejskole, Lyngby. Inst. for Kemiindustri). 1987. 346p. (In Danish). NTIS (US Sales Only), PC A15/MF A01. Order Number DE88755804/JAW.

The reaction between sulphur dioxide and lime stone particles within the temperature range of 500 - 075 deg. C was examined in three reactor systems: - An electrically heated recycle reactor. - An electrically heated laboratory fluidized bed reactor. - A coal fired pilot plant sized fluidized bed combustor. The evaluation of 23 primarily locally available limestones as desulphurization agents shows that they fall into ghree groups. The most reactive types are chalks of a porous, fine grained texture and of a relatively young geological age. The types with the lowest reactivity are geologically old, crystalline calcites of very low porosity. Type of intermediate reactivity are soft limestones of a porous, coarse grained texture. The effect of particle size, gas compositition and temperature on the rate of reaction and the extent of desulphurization was studied. During sulphation of a local chalk and limestone in the reactors a weak negative correlation between the sulphur capacity and the particle size was noted. This was not the case during pilot plant experiments, probably because of elutriation. The reaction between SO2 and CaCO3 at 600 deg. C appears to be influenced by concentrations of O2 and CO2. Around 850 deg. C a first order relation between the initial rate of sulphation and the concentration of SO2 was observed. For the local stones the final extent of sulphation was nearly unaffected by the concentration of SO2. Pore size distribution was determined by mercury penetration in the local chalk and limestone. In the raw materials the pore size distribution appears to be fairly narrow. During calcination a micropore structure was developed in the grains. The micropores were blocked during sulphation. Particle cross sections of the chalk were examined in a scanning electron microscope by energy dispersive X-ray analysis. Sulphation profiles were calculated on this basis. 152 refs. (AB).

10653 **(PB—89-118053/XAB) Coal-Waste Artificial Reef Program: reef measurements over four years in the sea. Final report.** Woodhead, P.M.J. (State Univ. of New York, Stony Brook (USA). Marine Sciences Research Center). May 1987. 92p. NTIS, PC A05/MF A01.

See also DE-82-900854.

In September 1980, a fishing reef was constructed off the shore of Long Island, southeast of the Fire Island Inlet. The reef consisted of 15,000 blocks made from coal-waste materials. The report documents the conclusions of a four-year project that monitored the physical properties, chemical changes, biological communities, and mineral phases of the reef in an ocean environment. Analyses were made based on the monitoring project, as well as an economics project conducted earlier and sponsored by the Electric Power Research Institute. Results showed the stabilized, coal-waste artificial reef had no adverse effect on the sea and showed no deterioration. Fish populations were normal and dense in number.

10654 **(PB—89-121842/XAB) Use of coal-combustion by-products as structural fill. Final report.** DeMuro, G.; Funk, A.C. (Environmental Resources Management, Inc., Exton, PA (USA)). Jul 1988. 62p. NTIS, PC A04/MF A01.

The report presents some basic concepts of materials science and structural engineering as they pertain to the use of coal-combustion by-products as structural fill material. The report also describes some physical and chemical properties of coal-combustion by-products which allow them to be used as structural fill material, and describes the effects of site characteristics on landfill design. Various techniques of ash placement are presently being used by Maryland utilities. No engineering failures at active coal-combustion by-product landfill sites have been reported.

10655 **(TNO-HMT—87-195) State-of-the-art report on the applicability of AFBB residues.** Gerritsen, R. (Hoofdgroep Maatschappelijke Technologie TNO, Apeldoorn (Netherlands)). Dec 1987. 49p. (In Dutch). Hoofdgroep Maatschappelijke Technologie TNO, Apeldoorn (Netherlands).

Within the framework of the National Onderzoekprogramma Kolen (NOK) investigations were made into the applicability and environmental aspects of residues from the atmospheric fluidized bed combustion of coal (AFBC-residues). The results of these investigations have been or are reported individually. In this report the state of the art with regard to the applicability and the environmental aspects of AFBC-residues are discussed on the basis of available literature and the results of the aforementioned investigations. Based on a simple model, predictions are made as to the composition of AFBC-residues expected to originate in the future from commercial fluidized bed combustion. In addition, a survey of possible applications of AFBC-residues is presented. For seemingly suitable applications an indication is given of the requirements the raw materials have to meet, and of the market for the application and the residues. Based on this and the results of the pilot investigation, a number of possible applications are presented as most suitable for the short, medium and long term. For the short term mention can be made of asphalt filler; low-cost artificial gravel and mass bricks are mentioned for the medium term, while bound road base material and building bricks are mentioned for the long term.

0109 Environmental Aspects

REFER ALSO TO CITATION(S) 10664, 11164

10656 **(AU/CE—1984) Coal conversion wastewater technology.** Hrudy, S.E.; Fedorak, P.M. (Alberta Univ., Edmonton (Canada). Dept. of Civil Engineering). 1984. 97p. (CE—02158). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

A serum bottle technique has been developed and used to study the anaerobic degradation of various phenolic substrates relevant to coal conversion wastewaters. A method for measuring absolute quantities of methane produced has been refined and applied to cultures maintained on both phenol and p-cresol. Oxidative treatment studies have demonstrated that such schemes do not offer useful application prior to anaerobic processes. Long-term experiments conclusively demonstrated the capability of anaerobic cultures to degrade m-cresol; presence of phenol and p-cresol was found to enhance this capability by shortening acclimation. Other long-term experiments indicated that the anaerobic degradability of o-cresol remains in doubt. The kinetics of phenol degradation in batch cultures containing various initial concentrations was also studied; at 43-199 mg/l levels, the final removal rates followed first order kinetics. Molecular hydrogen was identified as a possible limiting factor to the initiation of phenol degradation, and findings suggested phenol degraders prefer propionate over phenol as a substrate. A most probable number method, used for enumerating phenol degraders, estimated numbers too low to account for observed degradation rates, consistent with the hypothesis that phenol degradation depends on a consortium of organisms. Batch cultures could selectively degrade fermentable phenolics (mixed with nonfermentable ones) if the total phenolic concentration was near or below 700 mg/l. As other work has shown that fermentables comprise the majority of coal wastewater phenolics, such waters would be amenable to anaerobic biological treatment. 27 refs., 23 figs., 10 tabs.

10657 **(CGEE—8306) Performance evaluation of chemical sealants and crust retention on loaded coal trains.** Lanfranco, A.; Nieminen, G.; Guarnaschelli, C. (C.G. Environmental Engineering Ltd., Vancouver, British Columbia (Canada)). 1983. 171p. (CE—02161). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

The ability of chemical sealants to form a protective crust on the coal surfaces of open rail cars depends on type of sealant, solu-

tion concentration, coal surface preparation and weather conditions. The performance of various chemical binders was evaluated in terms of crust coverage, and is expressed here as a percentage of the surface crust retention. For the existing spray systems using latex-based sealant sprays, the crust coverage at the port was observed on approximately 2,000 coal cars originating from the B.C. Coal, Fording Coal, Cardinal River Coal and Luscar Sterco mines in British Columbia. Luscar Sterco achieved the highest overall average crust coverage of 81% ranging from 78 to 83%. Cardinal River ranged from 36 to 95% averaging 78%; B.C. Coal ranged from 50 to 89% averaging 77%; and Fording Coal ranged from 55 to 98% averaging 75%. For each mine, crust coverage was better on front slopes than rear slopes. Observed factors which had a more pronounced influence on crust retention include slope angle, rail car design, spray efficiency, volume of applied solution, slope length, irregular profiles and the presence of gouged areas resulting from the removal of overloads. Other observed factors that were either too difficult to analyze statistically, or too complex to quantify, are sealant solution concentration and weather conditions. 13 refs., 65 figs., 30 tabs.

10658 **(EPS—8311) The national coal wastewater study. Trace elements and organic compounds in Canadian coal wastewaters.** Paine, P.J.; Blakeman, W.B. (Environment Canada, Ottawa, Ontario. Environmental Protection Service). 1983. vp. (CE—02168). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

A wastewater sampling program was undertaken in Canada in 1982 to determine qualitative aspects of coal wastewater discharges from mines, preparation plants and bulk transfer/storage terminals. Grab samples of wastewaters from nine coal facilities (representative of type of coal produced, regional location and size) were collected and analyses for specific trace elements, organic compounds and inorganic compounds. Results indicate that of the 27 trace elements, Al, Fe and Sr occur at high concentrations at several sites. Boron in wastewaters from ignite coal mines of Saskatchewan was higher than at other facilities. The heavy metals (Cd, Pb, Hg) were at low concentrations in coal wastewaters and at relatively low concentrations in coal. The remaining trace elements were found to be present at low conecentrations and, at current discharge rates, given no cause for concern. Most of the 17 organic compounds analysed for are generally absent (i.e. not detected) or are present at trace concentrations (5-10 μg/l). Six compounds were at detectable (i.e. 10 μg/l) or greater concentrations. The most commonly occuring organic compounds were the phthalates and dichloromethane. Inorganic compounds were found to be present at low concentrations, although some sites exhibited high concentrations of certain parameters. pH values were noticeably lower at the eastern Canadian sites (Devco-Victoria Junction and Lingan) than at those in western Canada. 24 refs., 76 figs., 35 tabs.

10659 **(PB—89-117550/XAB) Electrostatic precipitation of particulate emissions from the combustion of coal-oil-water and coal-water-slurry in an industrial packaged boiler. Final report.** Noll, C.G.; Dooher, J.R. (United McGill Corp., Columbus, OH (USA)). Dec 1984. 52p. NTIS, PC A04/MF A01.

The report discusses the results of a research project designed to determine electrostatic-precipitation performance in collecting particulate emissions from coal-oil-water or coal-water slurry fuels. Measurements made on a mobile electrostatic precipitator (ESP) showed that New Source Performance Standards (NSPS) could be met by appropriate design and operation. Coal-oil-water fuels required a specific collection area (SCA) of 340 sq ft/1,000 ACFM flue gas, while coal-water slurry fuel needed 500 sq ft/ACFM flue gas to comply with NSPS. Specific electrode power densities were 200 watts/1,000 ACFM flue gas. The mobile ESP accepted flue gas from a packaged fire-tube boiler converted to coal-slurry firing. The fully instrumented boiler produced a fly-ash high-in carbon content, especially when burning CWS fuel. The high carbon content influenced fly-ash resistivity vs. temperature curves and must be taken into account in designing an ESP for this kind of service.

10660 **(PB—89-118061/XAB) Coal-water fuel supply and boiler-conversion study. Final report.** (Occidental Chemical Corp., Niagara Falls, NY (USA)). Oct 1986. 130p. NTIS, PC A07/MF A01.

This report presents the results of a study on the feasibility of converting an oil-fired boiler at Occidental Chemical Company's Niagara Falls, New York facility to coal/water slurry (CWS) fuel. The study evaluates technical and economic issues concerning a decision to convert the boiler. Conversion costs are weighted against CWS fuel-cost savings compared to oil and an acceptable market price for the CWS fuel is developed that provides a specified rate of return for the conversion. The report uses the target CWS fuel price in developing a design for a CWS fuel-production plant that could manufacture CWS at that price. In order to achieve the target price the CWS fuel-product plant must be sized to achieve economies of scale and plant output would be far in excess of the converted-boiler's demand. As a result of CWS fuel marketing study was undertaken to define additional boiler-conversion candidates in the western New York area. Without this additional CWS fuel demand, CWS cannot be produced at the target fuel price.

10661 **(WSL-LR—460-(AP)) Particulate sampling in the vicinity of the Aberaman phurnacite plant.** Woodfield, M.J.; Evans, P.; Horton, G. (Warren Spring Lab., Stevenage (UK)). Sep 1983. 52p. Department of Industry, Stevenage (United Kingdom). Warren Spring Laboratory.

Total Suspended Particulate (TSP) and benzene soluble matter (BSM) have been sampled in the residential areas surrounding the Aberaman Phurnacite Works, South Wales, to obtain community based data for comparison with existing works based data. It was found that in the residential areas the mean 24 hourly concentrations of Total Suspended Particulate - and probably benzene soluble material - were similar to or less than those in other areas of high population in the UK. The results when analysed with respect to wind direction did not show the Phurnacite plant to be a predominant source of either TSP or BSM. Conversely, a large source of both components is probably domestic coal burning.

0110 Reserves And Exploration

REFER ALSO TO CITATION(S) 11778

10662 (ACUNS—88, pp 111-120) **Sedimentology and stratigraphy of coal-bearing cretaceous-tertiary strata on the southeast coast of Baffin Island.** Burden, E.T.; Langille, A.B. (Memorial Univ. of Newfoundland, St. John's). 1988. Association of Canadian Universities for Northern Studies, 130 Albert Street, Ottawa, Ont., Canada K1P 5G4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN. (CONF-8511343—; MICROLOG—88-02606).

From National student conference on northern studies; Ottawa, Canada (18 Nov 1985).

Hydrocarbon sweeps were discovered off the coast of Baffin Island in Scott Inlet and in Buchan Gulf in 1976 and 1979 respectively. These discoveries renewed interest in the Mesozoic and Cenozoic Sedimentary rocks exposed along the southeast coast of Baffin Island and the possibility that hydrocarbon-bearing rocks may exist below Baffin Bay and Davis Strait. During the summer of 1985, geologic field work was conducted on the sedimentary outliers of Cretaceous-Tertiary age which exist between Cape Dyer and Quqaluit Island on the southeast coast of Baffin Island. This sedimentological and palynological investigation is an attempt to refine part of the geologic history of the Canadian North Atlantic. The sedimentary rocks: sandstones, shales, and minor coals, were deposited in a fluvial environment between 106 (Albion) and 60 (Paleocene) million years ago. The sediments contain the type of organic matter (lipid) which would source oil if subjected to the necessary parameters of time and temperature. Therefore, it is not unrealistic to state that offshore sediments may host hydrocarbons. 33 refs., 6 figs., 1 tab.

10663 (ACUNS—88, pp 68-70) **Physical and chemical characteristics of three subarctic peat-bogs.** Ditata, M. (McGill Univ., Montreal, Que.). 1988. (In French). Association of Canadian Universities for Northern Studies, 130 Albert Street, Ottawa, Ont., Canada K1P 5G4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN. (CONF-8511343—; MICROLOG—88-02606).

From National student conference on northern studies; Ottawa, Canada (18 Nov 1985).

A detailed description was made of three subartic peat-bogs in the Schefferville region. The purpose was to determine the distribution and organization of various characteristics of the peat, and also to study the evolution of the peat-bogs in different topographical and geographical environments. On the basis of detailed maps of the study sites, a number of transects were made, to ensure complete coverage of the sites. The sampling was made on the basis of homogenous units of vegetation along the transects. A detailed description of soil profiles was prepared after the environment of each sampling location had been described in general terms. Horizons were described in terms of their depth, their degree of decomposition, colour and type of material. pH measurements were also taken and notes made for each horizon. Soil samples were brought back for more detailed analysis of such features as ash and fibre content, capacity for cation exchange, humic acids. The accumulated data will be used to arrive at a three-dimensional concept of the sites and to work out a development sequence for each peat-bog. 2 refs., 4 figs.

0120 Mining

REFER ALSO TO CITATION(S) 10683, 11756

10664 (CMRC—82/34-T) **Selective handling costs for strip mine reclamation.** Chopiuk, R.G. (Coal Mining Research Centre, Edmonton, Alberta (Canada)). 1982. 16p. (CONF-8204201—; CE—02173). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

From Alberta reclamation conference; Alberta, Canada (14 Apr 1982).

One of the major tasks facing the coal mining industry today is dealing with environmental concerns. The requirement of selectively handling topsoil and subsoil for reclaiming plains strip mines is causing significant expenditures in overall mining costs. This report provides a reference that outlines the technical feasibility and comparative costs for six major methods of selctive materials handling. Specific systems covered include dragline, scraper/dozer, shovel/truck, bucket wheel excavator (BWE)/truck, BWE/cross-pit conveyor and BWE/round-the-pit conveyor. Evaluations are based on removal and placement of layers 1, 2 and 3 m deep. The selective handling methods used and costs incurred are site-specific and not necessarily applicable from mine to mine. Generally speaking, selectively handling thin layers with a dragline is not practical. Scraper and truck/loader operations are reasonably well-suited to such tasks and may be the best choice for existing operations where a dragline is already in place as the primary excavator. BWE/conveyor systems have a relatively high investment requirement and are, therefore, usually too expensive to operate as auxiliary equipment for handling topsoil and subsoil only. Howver, if such systems are brought in as the primary stripping machines, it may be possible to realize lower total costs overall for mining and selective handling, (particularly with the cross-pit conveyors) compared to the dragline system. Such BWE/conveyor systems are still unproven in western Canadian coal mines. 2 refs., 5 figs., 6 tabs.

10665 (NEI-FI—58) **Preconditions of Peat Harvesting in Finnish Central-Lapland.** Tapio, E.; Klemetti, V. (Vapo Oy, Oulu (Finland)). Dec 1987. 55p. (In Finnish). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88755819/JAW.

The aim of the study was to find out the effects of the differences in weather and geographical conditions on the preconditions of peat harvesting in the Finnish Central Lapland. The survey was done by conducting practical peat harvesting tests in three harvesting sites in Central Lapland and by comparing the results to the results of Piipsanneva site in Haapavesi. The range of the various weather parameters and the drying time of peat were measured during the years 1981-1986. The results prove, that the summers were 1-2 deg C cooler in Central Lapland than in Haapavesi. The net evaporation was lower, the frozen peat layer thicker, and the melting date of the frost later in Central Lapland than in Haapavesi. Due to these facts the drying time of peat was definitely longer in Central Lapland. The differences are moe obvious during bad summers, while the good summers are almost equal in different parts of the country. The securing of the deliveries of the same quantities of peat requires in Central Lapland larger peat harvesting area than in Central Finland. In the future, when the peat combustion techniques develop further, the possibility to harvest peat in higher moisture content will probably improve the preconditions of peat harvesting in Central Lapland.

10666 (NMRDI—2-74-4613/I) **Development of a coal-rock interface sensor (Phase 1): Final technical report.** Stolarczyk, L.G. (Stolar, Inc., Raton, NM (USA)). Nov 1988. 58p. NTIS, PC A04/MF A01 - OSTI - New Mexico Energy Research Development Institute, Suite M, 457 Washington SE, Albuquerque, NM 87108. Order Number DE89005221/JAW.

Research under Phase 1 was performed to determine the feasibility of horizon sensor technology. The proposed horizon sensor is based on an electromagnetic (EM) wave process and will be used to detect changes in uncut coal thickness on the roof and floor of mines. The sensor is composed of a horizontal loop antenna which is driven at its resonant frequency. The input conductance of the loop is measured and correlated with coal layer thickness using electronic circuits interfaced to a microprocessor. Control information is presented to the shearing machine operator indicating if the cutting drum should be lowered or raised to return the coal layer to the desired thickness. The sensor will be mounted on the shearing machine and will be extended to a position directly behind the cowl of the cutting drum. 6 refs., 26 figs.

10667 (NMRDI—2-74-4613/II) **Development of a coal-rock interface sensor (Phase II): Final technical report.** Stolarczyk, L.G. (New Mexico Research and Development Inst., Santa Fe (USA); Stolar, Inc., Raton, NM (USA)). Nov 1988. 108p. NTIS, PC A06/MF A01 - New Mexico Research and Development Institute, Suite M, 457 Washington SE, Albuquerque, NM 87108. Order Number DE89005222/JAW.

Research under Phase II was performed to develop prototype horizon sensor technology and evaluate the technology in an underground coal mine. The horizon sensor technology is based upon the propagation of electromagnetic (EM) waves through layers of natural media with contrasting electric parameters (dielectric constant and conductivity). The EM wave launching antenna input terminal admittance depends on the thickness and contrast of the natural media layers. A loop antenna operated at its resonant frequency exhibits an input admittance that is most sensitive to changes in thickness and electrical parameters. The sensor measures the antenna input admittance in a Maxwell bridge and a microcomputer is used to compute the real-time admittance. Changes in admittance are used to generate control signals that tell the shearing machine operator if the cutting drum should be lowered or raised to maintain the desired uncut coal thickness. Field evaluation indicated that the sensor could detect uncut coal thickness changes in an actual underground coal mine. 3 refs., 45 figs., 4 tabs.

10668 (PB—89-124788/XAB) **Electrical-hazards awareness program.** McLaughlin, A.D.; O'Neal, D.C. (National Mine Health and Safety Academy, Beckley, WV (USA)). 1986. 356p. NTIS, PC A16/MF A01.

Also available from Supt. of Docs.

This program was developed to increase the awareness of electrical hazards that exist in mines. The material was developed as a supplement to trainers' mine-specific needs, not as a substitute. Trainers should take time to review and summarize the electrical problems experienced at their mine. Some of the sections contain illustrations that can be made into overhead transparencies. Some sections are presented in slide/tape format. The trainers may

choose to use the script and take their own slides for a personal touch. They may also use the slides and script as an outline for their lecture. The subtopics covered are: Introduction to Electricity; Statistics; Underground Electrical Equipment; Permissibility; Mine Electrical Substations; Grounding; Methane Monitors; Battery and Battery-Charging Safety; Overhead Power Line Hazards; Trailing Cables; Trolley Wires and Feeder Wires Underground; and Electrical Fatalities.

0130 Transport And Handling

REFER ALSO TO CITATION(S) 11554

10669 **(DOE/PC/90958—T6) Study of dense phase coal transport in plugs: Quarterly report, July--September 1988.** Klinzing, G.E. (Pittsburgh Univ., PA (USA). Dept. of Chemical and Petroleum Engineering). 1 Nov 1988. Contract FG22-86PC90958. 12p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89004010/JAW.

During the past quarter some interesting observations were made on the form on the coal plug as it moved through the one inch pipe. It appears as if a stagnant layer of coal occupies the lower third to half of the pipe while the upper section transports the coal. The moving plug thus has a half cylinder shape. It is conjectured that for layer pipes this type of plug shape would be similar or even more extreme since the gravity effects are greater. An mathematical analysis was performed on the type of plug movement noting that the upper section of the plug slides on the wall surface while the lower has a powder-powder shear stress. The analytical results obtained agreed with the pressure drop measurements carried out on these plugs. Fundamental shear stress measurements were again performed using the Jenike Shear Cell. A dimensional analysis of the plug flow system was carried out using the data obtained from the previous tests on fine coal plugs. Performing this analysis yielded a dimensionless number that characterize the minimum stable plug lengths possible for fine coal movement. This information is useful in establishing bounds on the flow conditions. 3 figs., 2 tabs.

10670 **(NEI-FI—60) Automatic energy value and quality determination in the storage of milled peat.** Pesonen, J. (Turveruukki Oy, Rantsila (Finland)). Dec 1987. 73p. (In Finnish). NTIS (US Sales Only), PC A04. Order Number DE88755821/JAW.

The aim of the present work was to develop a measuring device for attachment to a milled peat loader which would enable continuous recording of the quantities of peat dispatched and its moisture content and which could be linked to a microcomputer for calculation of energy content and output of reports. Design of the measurement method and prototype was commenced for the degree dissertation /sup T/he basic of quality and quantity measurement during milled peat loading/sup /submitted to the University of Oulu in spring 1986. This work surveyed the range of suitable measurement techniques, presented the desing of a device for this purpose and estimated the accuracy and reliability of the method. Further trials with the prototype during the summers of 1986 and 1987 have shown that the measurement principle works well under normal on-site production conditions. Quantity measurements are based on the depth of the peat carried on the conveyor belt of the loader, measured by three ultrasound distance transducers, and the rate of movement of the belt, measured using an inductive rotation speed transducer. Moisture content is measured by continuous sampling of the peat by means of a screw feeder for analysis by a PT-53 rapid-action moisture meter. The control and data acquisition system comprises an Epson PX-8 microcomputer with appropriate programs and uMAC-4000 data acquisition and control card with peripherals.

0140 Combustion

REFER ALSO TO CITATION(S) 10655, 10661, 11293

10671 **(CONF-8810252—1) Calculations of the chemistry of coal combustion effluents.** Blander, M.; Sinha, S.; Pelton, A.; Eriksson, G. (Argonne National Lab., IL (USA); Ecole Polytechnique, Montreal, Quebec (Canada)). 1988. Contract W-31109-ENG-38. 6p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89003596/JAW.

From American Flame Research Committee fall meeting; Pittsburgh, PA, USA (4 Oct 1988).

Unique computer programs and solution models have been developed to perform calculations of the chemistry of coal combustion involving hundreds of chemical species in gaseous, solid and liquid phases, as well as the complex solution chemistry inherent in liquid silicates. In addition, we have shown that kinetic constraints on the equilibria can alter the chemistry in significant ways. For Illinois No. 6 coal at high temperatures ($\geqq$1400 K), the condensed phases are liquid and solid silicates, silica, and iron oxides (magnetite and hematite). At lower temperatures, liquid and solid sulfates, silica, and solid silicates are present. Because of the relative volatility of alkalis (as NaCl(g)) and the relatively slow kinetics expected for the reaction of SO_3 and NaCl with solid silicates, liquid alkali sulfates can form on particulate surfaces, enhancing agglomeration and fouling. In addition, corrosion by both liquid silicates and sulfates can be significant. The computer calculations provide detailed information on the total chemistry of coal combustion, some of which may be difficult to measure. When coupled with an experimental program that permits the deduction of kinetic constraints for a particular mode of combustion, the computer program will permit one to make reliable predictions, and, thus, greatly reduce the number of measurements needed to deduce the chemistry for any particular coal. Our methods provide a promising tool for formulating strategies to reduce fouling and corrosion. 12 refs., 2 tabs.

10672 **(CTH-IE-T—85-130) Measurements of gas profiles in the Chalmers fluidized bed boiler.** Karlsson, M. (Chalmers Univ. of Tech., Goeteborg (Sweden). Dept. of Energy Conversion). Nov 1985. 42p. (In Swedish). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755761/JAW.

Concentration profiles of NO/sub x/, CO, CO/sub 2/, O/sub 2/ and SO/sub 2/ in the freeboard of the steam boiler with fluidized bed at Chalmers power station have been measured. Comments are made on the NO/sub x/ profiles with the help of some articles in the field of NO/sub x/ limitation. The results of the measurements can be summarized in the following five points: * The vertical NO/sub x/ concentration profile in the Chalmers boiler has an appearance similar to profiles in other experimental installations where measurements have been carried out. * The horizontal NO/sub x/ profile is levelled out because of the reduction of NO with existing NH/sub 3/. * The measurements show that an NO reduction takes place with the help of injected NH/sub 3/. * The measured NO/sub x/ profile when NH/sub 3/ is injected is compared with earlier experiments in another installation. * The measurements at the Chalmers boiler have provided experience which can become the basis for improvements in the measuring equipment in the future.

10673 **(DOE/MC/14536—2544) Atmospheric fluidized bed combustion: A technical source book: Final report.** Tung, Shao-E.; Williams, G.C. (Massachusetts Inst. of Tech., Cambridge (USA)). Jan 1987. Contract AC21-80MC14536. 1392p. NTIS, PC A99/MF A01 - OSTI; 1; GPO Dep. Order Number DE88001042/JAW.

Although years of study and evaluation have been spent on the energy problem, only recently have preferred choices become more clearly defined. Atmospheric fluidized-bed combustion (AFBC) is one of but a few choices that offers a promise to use high sulfur coal, in the near term, in an environmentally acceptable manner. Most of the research and development work on AFBC has been done in the past 20 years. It was first motivated by human concerns about the environment and subsequently heightened by the 1973 energy crisis. During these 20 years, significant progress

has been made and many research results have been published. As the technology matured toward commercialization, engineers often had difficulty finding the required information that is scattered throughout extensive literature. Furthermore, while there is a need for quick access to the accumulated knowledge for those engaged in designing AFBC systems and subsystems, the need for such access is equally important to AFBC users, who must operate these new combustion systems. This Source Book is the result of an effort to satisfy those needs first perceived by the DOE Morgantown Energy Technology Center (METC) under whose sponsorship this Source Book was compiled. The book, in our view, is an example of one of the many ways the Federal Government can assist in the development of a new technology. The primary goal of the Source Book is to bring together relevant information on AFBC under one compilation and place it at the disposal of scientists and engineers engaged in the design and/or use of AFBC systems.

10674 **(DOE/METC—88/6094) Proceedings of the annual coal fuel heat engines and gas stream cleanup systems contractors review meeting.** Dellefield, R.J.; Webb, H.A. (eds.). (USDOE Morgantown Energy Technology Center, WV). Jun 1988. 451p. (CONF-880656—). NTIS, PC A20/MF A01 - OSTI. Order Number DE88001088/JAW.

From Annual coal fuel heat engines and gas stream cleanup systems contractors review meeting; Morgantown, WV, USA (14 Jun 1988).

This annual meeting provided a forum for the exchange of information between DOE contractors and interested parties, and this year's meeting was attended by 236 individuals from industry, academia, national laboratories, and other Governmental agencies. The overall objective of these programs is the development of technology that is essential for private sector commercialization of integrated heat engine and gas stream cleanup systems which will produce power from coal in a cost competitive and environmentally acceptable manner. Forty two projects are presented and processed separately for the data bases.

10675 **(DOE/PC/60419—T8) Development of a pulsed coal combustor fired with CWM [coal-water mixture]: Technical progress report, September 23--December 29, 1985.** (Management and Technical Consultants, Inc., Columbia, MD (USA)). 1 Feb 1986. Contract AC22-83PC60419. 27p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89003855/JAW.

The program objective is to develop a new burner technology which would facilitate the replacement of a significant fraction of current oil and gas firing in the US with less costly and strategically more acceptable coal-water mixture (CWM) fuels. This burner technology will utilize the principle of pulse combustion to permit burning of CWM fuels in a manner compatible with the technical requirements of the applications and satisfying environmental constraints. The program considers retrofit of the new technology to utility and industrial boilers and process heaters presently firing oil and gas and the use of the technology in new equipment burning CWM. This report is intended to summarize the significant technical results of work completed during the period September 24, 1985 through December 29, 1985. Sections 2.0 and 3.0 of the report provide the technical background and a description of the program. The most significant technical results from the reporting period are presented in summary form in Section 4.0. 5 figs., 2 tabs.

10676 **(DOE/PC/60419—T9) Development of a pulsed coal combustor fired with CWM: Technical progress report, December 30, 1985--March 23, 1986.** (Management and Technical Consultants, Inc., Columbia, MD (USA)). 1 Jun 1986. Contract AC22-83PC60419. 22p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89003854/JAW.

The program objective is to develop a new burner technology which would facilitate the replacement of a significant fraction of current oil and gas firing in the US with less costly and strategically more acceptable coal-water mixture (CWM) fuels. This burner technology will utilize the principle of pulse combustion to permit burning of CWM fuels in a manner compatible with the technical requirements of the applications and satisfying environmental constraints. The program considers retrofit of the new technology to utility and industrial boilers and process heaters presently firing oil and gas and the use of the technology in new equipment burning CWM. This report is intended to summarize the significant technical results of work completed during the period December 30, 1985 through March 23, 1986 Sections 2.0 and 3.0 of the report provide the technical background and a description of the program. The most significant technical results from the reporting period are presented in summary form in Section 4.0. 2 refs., 5 figs., 2 tabs.

10677 **(IS-M—617) A method for improving load turndown in fluidized bed combustors.** Brown, R.C.; Foley, J.E. (Ames Lab., IA (USA)). 1987. Contract W-7405-ENG-82. 8p. (CONF-870816—29). NTIS, PC A02/MF A01 - OSTI. Order Number DE89003743/JAW.

From 24. national heat transfer conference and exhibition; Pittsburgh, PA, USA (9 Aug 1987).

The authors are investigating a new concept in the design of fluidized bed combustors that improves load turndown capability. This design is based on control of heat transfer rate independent of combustion rate. The configuration under investigation consists of a central combustion bed surrounded by an annular fluidized bed that establishes overall heat transfer rate from the inner combustion bed. The two beds, physically divided by a wall, are fluidized independently by separate air plenums. Experiments were performed to evaluate the usefulness of this device in improving load turndown. For a given combustor firing rate and air-to-fuel ratio, a wide variation in combustion temperature could be achieved by controlling the flow of fluidization air to the annular fluidized bed. In other tests, a load turndown ratio of 8.7 was achieved while combustion temperature was held constant. Greater load turndowns are expected as a result of the use of smaller particles and higher fluidization velocities in the annular bed. 8 refs., 6 figs., 1 tab.

10678 **(QFBC-TR—87-3) Pilot scale trials on atmospheric fluidized bed combustion of a Western Canadian sub-bituminous coal (Highvale).** Becker, H.A.; Code, R.K.; Stephenson, J.R. (Canada Centre for Mineral and Energy Technology, Ottawa, Ontario). 1987. 41p. CANMET, 555 Booth St., Ottawa, Ontario, Canada K1A OG1.

Pilot scale tests on the burning of Western Canadian sub-bituminous coal by an atmospheric fluidized bed combustor are reported. The effects of operating parameters such as coal particle diameter, fluidizing velocity, excess air, recycling ratio, and bed temperature are discussed. Research indicates that this coal can be burned with high efficiency by AFBC at temperatures of 750-900 degrees C. By recycling a portion of the cyclone product, carbon burn-up efficiencies higher than 99% can be attained. Studies conducted on sub-bituminous and bituminous coals have indicated there is a strong correlation of overhead carbon loss with fuel free swelling index. Char particles originating from highly swelling fuels are apparently more prone to fragmentation and subsequent elutriation in the fluidized bed environment. 7 refs., 20 figs., 5 tabs.

10679 **(QFBC-TR—87-4) Pilot scale trials on atmospheric fluidized bed combustion of a British Columbian anthracite (Mt. Klappan).** Becker, H.A.; Code, R.K.; Stephenson, J.R. (Canada Centre for Mineral and Energy Technology, Ottawa, Ontario). 1987. 37p. CANMET, 555 Booth St., Ottawa, Canada K1A OG1.

Pilot scale tests on the burning of an anthracite from the Mt Klappan region of British Columbia, in an atmospheric fluidized bed combustor, are discussed. Carbon, sulphur and nitrogen balances were carried out on the combustor and the results are summarized in terms of the ratio of the fluxes of a particular component in the process streams of interest. This is a convenient format for examining the extent of carbon combustion and fate of other constituents in the fuel. A high recycle of elutriated fines is necessary to achieve an acceptable level of carbon efficiency with Mt. Klappan coal. Overhead carbon losses can amount to as much as 20% of the carbon in the fuel without recycle of cyclone solids. 5 refs., 18 figs., 3 tabs.

10680 **(SAND—88-8260) Coal combustion science: Quarterly progress report, April--June 1988.** Hardesty, D.R. (ed.). (Sandia National Labs., Livermore, CA (USA)). Nov 1988. Contract AC04-76DR00789. 66p. NTIS, PC A04/MF A01 - OSTI; 1; GPO Dep. Order Number DE89003231/JAW.

The objective of this activity is to support the Office of Fossil Energy in executing research on coal combustion science. This activity includes two coordinated elements: (1) basic research on coal combustion which supports both the Pittsburgh Energy Technology Center (PETC) Direct Utilization Advanced Research and Technology Development Program, and the International Energy Agency (IEA) Coal Combustion Science Project; and (2) planning and administration support to DOE as the Operating Agent for the IEA Project. Specific tasks for this activity include: coal devolatilization, coal char combustion and fate of mineral matter during coal combustion. 9 refs., 25 figs., 2 tabs.

10681 **(STEV-FBT—88-22) IEA, Co-operation in the field of atmospheric fluidized bed combustion in industrial or district heating boilers, Annual report 1987.** (Statens Energiverk, Stockholm (Sweden); New Energy and Industrial Technology Development Organization, Tokyo (Japan)). Mar 1988. 103p. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88755876/JAW.

The objective of the IEA Atmospheric Fluidized Bed Combustion (AFBC) Program is to demonstrate the technical feasibility, reliability and economy of employing the AFBC technique in boilers and thus providing design and operating experience for extensive application. There are eleven member countries participating in the program: Canada, Denmark, Italy, Japan, the Netherlands, Norway, New Zealand, Portugal, Sweden, Switzerland, and Yugoslavia. They have all attempted to design, construct and operate AFBC units for power generation, industrial process heat or district heating. They have also agreed to share the technical knowledge and the operating experience gained from the installations. The chairman expressed his hope that he would like to increase the participating member countries such as Austria, Federal Republic of Germany, United Kingdom, the United States of America, and so on. However, it is felt rather difficult at this moment, for him to practically materialize the new mwmbership, of those nations stated above. U.S.DOE observer, Mr. P.J. Muchunas replied the chairman, Mr. K. Hosaka in his letter of October 14, 1987 that U.S.Doe could not accept the chairmans' invitation to participate in the IEA-AFBC membership, because of the article 2 requirement of the IEA agreement which assumes each member country to offer technical information of their national project on fluidized bed combustion system. In the mean time, Yugoslavia formally joined the IEA-AFBC framework in signing the agreement on June 26, 1987, after Portugal had entered the framework as a formal member in February, 1987. These new countries increased the authorized participants based on the IEA-AFBC agreement from 9 to 11 countries.

0150 Marketing And Economics

REFER ALSO TO CITATION(S) 10619, 10888, 11191

10682 **(NEI-FI—46) Suitability of peat pellets for the Finnish energy market.** Aalander, I. (Kauppa-ja Teollisuusministerio, Helsinki (Finland). Energiaosasto). 1986. 48p. (In Finnish). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755808/JAW.

The purpose of the research project was to investigate the suitability of peat pellets for the Finnish energy market in both technical and commercial respects. The subject of the investigation was the use of pellets as supporting fuel, as exclusive fuel. Besides the questions related to the use of pellets, special attention was paid to the formation of markets for both methods of application. The investigation was closely connected to the practical circumstances, and therefore the importance of the data obtained from the applications has been emphasized. As rgards the use of pellets as supporting fuel, the following aspects were investigated in plants of 0.5 to 27 MW: In what kinds of plants are the pellets in view of their burning characteristics, suitable to be used as supporting fuel for solid fuels? What are the advantages and disadvantages of the pellets used as supporting fuel? What are the problems related to the transport, storage and handling of pellets? What is the price worth while paying for the pellets used as supporting fuel? As regards the pellet burning, the following aspects were investigated in plants of 10 to 500 kW: The most advantageous way to burn pellets automatically in different size classes. What kinds of burners and feeders are needed to make pellet usage possible? Questions related to the storage, transport and distribution of pellets. The advantages and disadvantages of pellets as compared with other solid fuels and especially with light fuel oil. Furthermore, efforts have been made to define the criteria for the pellet quality and manageability which make the pellet an article which is better than other domestic fuels.

0160 Health And Safety

REFER ALSO TO CITATION(S) 10668

10683 **(IOM-TM—88-13S) Notes of guidance for the Health and Safety Executive on working in hot conditions in mining.** Graves, R.J.; Graveling, R.A. (Institute of Occupational Medicine, Edinburgh (UK)). Jun 1987. 21p. Institute of Occupational Medicine, Edinburgh (UK).

These guidance notes have been produced following the production of a review of the literature on working in hot conditions in mining produced by the Institute of Occupational Health and Safety Executive (IOM Technical Memorandum TM/88/13), They provide a brief overview of the methods which can be used to assess the effects of hot conditions in mining (including the use of the simple index, complex indexes and direct measurements of workers) and the application of 'basic effective temperature' to mining. These notes also provide guidance on the practical issues facing the inspector or other official in interpreting the measurements which can be taken on an initial evaluation.

0170 Legislation And Regulations

REFER ALSO TO CITATION(S) 11164

02 PETROLEUM

0202 Geology And Exploration

REFER ALSO TO CITATION(S) 10662, 10710

10684 **(NP—9770185) Two- and three-dimensional simulations of the induction-log.** Kuth, C. (Koeln Univ. (Germany, F.R.). Inst. fuer Geophysik und Meteorologie). 1987. 114p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89770185/JAW.

In this paper a multifrequent method for induction log sounding is presented. This method, introduced under the name of induction-wave-log uses the skin effect which is increasing with an increasing frequency. Because of the different penetration depths, information on different rock regions can be gathered with the help of induction-wave-log sounding which typically is carried out with several discrete frequencies in the range from 10kHz to 1MHz. This property was used in the framework of a multifrequent inversion process. With consideration to frequency-dependent conductivities a specific frequency for every rock conductivity could be given by means of this multifrequent inversion process. In the second part of this paper the development of a three-dimensional model for induction log is described. For the execution of the simulation a finite-element algorithm was developed. The specific features of such a numeric process are discussed with regard to induction log simulation.

10685 **(PB—89-102347/XAB) Draft environmental impact statement for Gulf of Mexico Sales 118 and 122: central and western planning areas.** (Minerals Management Service, Metairie, LA (USA). Gulf of Mexico OCS Regional Office). Mar 1988. 415p. (MMS/GM—0003). NTIS, PC A18/MF A01.

The Environmental Impact Statement (EIS) is a description of the environmental aspects and impacts of oil and gas activities resulting from this lease sale or the states bordering the Gulf of Mexico. It provides a description of the area, affected environment, and environmental consequences; it discusses the proposed action, issues and areas of concern, and the major differences of holding this lease sale.

0203 Drilling And Production

REFER ALSO TO CITATION(S) 11465, 11500

10686 **(CMI-R—30151-1) Division of profits by coordination of the petroleum activity.** Hallefjord, Aa.; Helming, R.; Joernsten, K. (Christian Michelsens Inst. for Vitenskap og Aandsfrihet, Bergen (Norway)). Jun 1988. 45p. (In Norwegian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755759/JAW.

Coordination of the petroleum activity can contribute to a reduction of the total costs. In this paper three forms of coordination are studied: the use of common process installations and transport systems as well as the unitization of oil fields. For each approach two aspects are discussed, namely justice and economic effectiveness. 17 refs.

10687 **(CMI-R—30901-1) Mathematical programming model for the development of petroleum fields and transport systems.** Aboudi, R.; Hallefjord, Aa.; Helgesen, C.; Helming, R.; Joernsten, K.; Pettersen, A.S.; Raum, T.; Spence, P. (Christian Michelsens Inst. for Vitenskap og Aandsfrihet, Bergen (Norway)). Jun 1988. 25p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755760/JAW.

This paper describes the accomplishment of an operations research project concerning the development of petroleum fields and transport systems. All phases of the project are reported - the first contact with the client, the discussions that lead to the formulation of a mathematical programming model, the choice of solution techniques and the computer implementation of a userfriendly system to be used by planners as a means of decision support. 11 refs.

10688 **(DOE/BC/14126—2) Detecting linear barriers by type curve analysis: Supri TR 61.** Riley, M. (Stanford Univ., CA (USA). Petroleum Research Inst.). Nov 1988. Contract FG19-87BC14126. 56p. NTIS, PC A04/MF A01 - OSTI; 1; GPO Dep. Order Number DE88001246/JAW.

The effect of a linear barrier (the semi-infinite system) on the pressure behavior of a single well test has been recognized for many years. The characteristic doubling of slope on a semilog graph has been used to determine the existence of a fault and to determine its distance from the well tested. The equations governing this behavior are quite straightforward and understandable; hence the presence of a sealing fault is often used as an explanation for anomalous pressure behavior even when it is not justified. Alternatively, when a change in slope is not observed, the absence of a second straight line is used to calculate a minimum fault distance. Although, this is reasonable in theory, the radius of investigation method normally used for this calculation will overestimate this distance. This study uses the pressure derivative and equivalent drawndown time, to present type curves for a semi-infinite system on a single log-log graph. This presentation allows the determination of permeability, skin and fault distance from a single match. The type curves can be used to analyze data from either drawdown or buildup tests, and there is no restriction on production time in the case of buildup testing. Prior to this study, there was no method available to analyze buildup data from a semi-infinite system following a short flow period. The value of the log-log presentation is that it allows for verification that the correct model is being used. Since the pressure derivative is merely the slope of the semilog graph, a minimum distance to a barrier can be calculated from the type curve when only infinite acting data are available. Type curves are also presented for the case of a well with wellbore storage and skin producing in the presence of a boundary. These type curves show that reasonable values of wellbore storage and skin can completely mask the effects of a boundary. 27 refs., 21 figs.

10689 **(DOE/BC/14126—3) Foam and emulsion effects on gas driven oil recovery.** Farrell. J.; Marsden, S.S. Jr. (Stanford Univ., CA (USA). Petroleum Research Inst.). Nov 1988. Contract AC03-81SF11564;FG19-87BC14126. 28p. (SUPRI-TR—62). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE88001247/JAW.

The aim of this research was to investigate the gas mobility reducing effects that a gas driven surfactant slug has on enhanced oil recovery (EOR). Three chemically similar surfactants whose properties graded from foaming agent to emulsifying agent were used to study the effects that foam and emulsion formation have on enhanced oil recovery in an unconsolidated Ottawa sand model at room temperature. Both the foam lamellae and the emulsion droplets act to reduce the mobility of the injected gas in the swept zone, thus increasing the vertical sweep efficiency. Shell's Enordet series of alcohol ethoxylate surfactants were used in the study at three different concentrations of, 0.01%, 0.03% and 0.100% (wt.). The experimental procedure consisted of displacing oil from a porous medium at residual water saturation by injecting carbon dioxide, followed first by the injection of a 0.20 pore volume slug of surfactant solution, then by carbon dioxide gas at low pressure. Measurements were made of the cumulative produced gas and liquids. Performance differences between different surfactants are small but consistent. Combining the foam and emulsion mechanisms seems to lead to more efficient oil recovery than either mechanism alone. 33 refs., 14 figs., 3 tabs.

10690 **(DOE/BC/14126—5) SUPRI heavy oil research program: Eleventh annual report, October 1, 1986--September 30, 1987.** Brigham, W.E.; Castanier, L.M. (Stanford Univ., CA (USA). Petroleum Research Inst.). Nov 1988. Contract FG19-87BC14126. 93p. (SUPRI-TR—64). NTIS, PC A05/MF A01 - OSTI; 1; GPO Dep. Order Number DE89000703/JAW.

The following heavy oil research areas are described: Flow Properties Study; In-Situ Combustion; Steam Injection with Additives; Reservoir Definition; and Field Support Services. Individual projects within each area are processed separately for the data bases. (CBS)

10691 **(RF/PRC/T—1/87) Nitrogen injection.** Gard, J.; Hanssen, J.E.; Norvik, H. (Rogalandsforskning, Stavanger (Norway)). Jan 1987. 27p. (In Norwegian). NTIS (US Sales Only), PC A03. Order Number DE88755842/JAW.

The report gives an analysis on the process of nitrogen injection for the enhanced recovery of petroleum from the reservoirs on the Norwegian continental shelf. The ability of the commonly used analysis (Peng-Robinson) to predict the high-pressure phase behaviour of the N/sub 2/-C/sub 1/-nC/sub 1/0 system in the 37-137 deg Celsius temperature range and the high-pressure phase behaviour of a ternary mixture of hydrocarbons in the temperature range 0-240 deg Celsius is evaluated. The report also evaluates a modified correlation for minimum miscibility pressure in the vaporizing drive process and the effect of intermediates in reservoir oil on nitrogen miscibility. 14 drawings, 2 tables.

10692 **(RF/PRC/T—3/87) Acidization.** Roedal, J. (Rogalandsforskning, Stavanger (Norway)). Mar 1987. 91p. (In Norwegian). NTIS (US Sales Only), PC A05. Order Number DE88755843/JAW.

The present report gives a survey on acidization. The acidization and hydraulic fracturing techniques constitute the main field of well stimulation intending to increase the productivity from petroleum wells. The report discusses the various acidization techniques, and compares the most useful acid systems and adding materials. The formation damages and scaling problems are considered. 12 drawings, 1 table, 47 references.

10693 **(SAND—88-2678) Final technical poster session for the Multiwell Experiment, SPE/DOE symposium on low permeability reservoirs.** Finley, S.J. (ed.). (Sandia National Labs., Albuquerque, NM (USA)). Nov 1988. Contract AC04-76DP00789. 92p. (CONF-870529—3). NTIS, PC A05 - OSTI. Order Number DE89003422/JAW.

From Society of Petroleum Engineers meeting on low permeability reservoirs; Denver, CO, USA (18 May 1987).

A special technical poster session describing the Multiwell Experiment was held during the 1987 Society of Petroleum Engineers/US Department of Energy Symposium on Low Permeability Reservoirs, May 18-19, 1987, Denver, Colorado. Project activities and results were summarized by depositional environment. The overall project contributions were outlined. This summary provides a photographic record of the information presented at that technical session and identifies personnel associated with the various activities. 5 refs.

10694 **(UA—9003498) An experimental study of a waterflood enhanced oil recovery case history: The Citronelle Field, Mobile County, Alabama: Final report for 1986/1987 SOMED [School of Mines and Energy Development] project.** Donahoe, R.J. (Alabama Univ., University (USA). School of Mines and Energy Development). Mar 1988. 41p. OSTI - SOMED, P.O. Box 6282, University of Alabama, Tuscaloosa, AL 35487-6282. Order Number TI89003498/JAW.

Faculty research report No. 90.

A low-temperature hydrothermal flow-through study was conducted which attempted to model mineral reactions that occurred in the Rodessa Formation sands at Citronelle Field as the result of the waterflood enhanced oil recovery program employed there. Six experiments were conducted at 110{degree}C and 300 bar pressure using a 0.5 ml fluid flow rate. Experimental variables were: (1) solution composition (distilled, deionized water; Citronelle injection water without chemical additives; Citronelle injection water with surfactant and oxygen scavenger chemical additives; 4% KCl solution with surfactant chemical additive) and (2) solid sample composition. Dissolution of sandstone framework and authigenic mineral constituents result in increased sample permeability. Improvement in reservoir permeability should be greatest near injection wells, where mineral dissolution rates are highest. Well treatments using potassium chloride solutions promote the rapid growth of authigenic illite in Sand No. 36, probably through the interaction of K^+ with feldspars and/or kaolinite. Well bore area damage can be expected to result from this treatment procedure. Substantial kaolinite migration was found to occur and is postulated to be a potential source of reservoir damage, particularly around injection wells. Both silica and calcium carbonate precipitation were documented to occur in most of the experiments. Differences in the mobilities of these substances in the pH range 3.6-6.5 lead to the interpretation that silica fouling damage should primarily affect injection wells, and calcite cement damage should be primarily concentrated around production wells. Further study is required to characterize the migration paths of these precipitates in the sand unit. 11 refs., 15 figs., 5 tabs.

0204 Processing

REFER ALSO TO CITATION(S) 10620, 11798

0205 Products And By-products

10695 **(PB—89-113492/XAB) Bacteria and asphalt stripping. Final report, December 1983-August 1987.** Ramamurti, K.; Jayaprakash, G.P. (Kansas Dept. of Transportation, Topeka (USA). Bureau of Materials and Research). Aug 1987. 34p. NTIS, PC A03/MF A01.

See also PB—85-103455.

Major types of bituminous pavement distress were rutting, cracking (longitudinal, transverse, and alligator) and stripping. The rubble and loosely bound material contained bacteria. The deterioration lessened upward from the pavement-soil interface. The soil appears to be the prime source of the bacteria. Most of the bacterial cells were sausage shaped with polar flagellation. They appeared to belong to the genus Pseudomonas, which is a known user of asphaltic hydrocarbons. Cocci-type bacteria and a virus were also noted. Increasing the density of some asphaltic concrete and strengthening the bond between aggregate and asphalt are considered as the preferred alternatives to using chemical biocides. Anything to reduce pavement cracking would help. Adding lime to asphalt mixes may be one effective means of improving aggregate-asphalt bond and controlling biodeterioration. Lime stabilization of soils under asphalt pavements may provide an added protection against bacterial attack by rendering the soil more hostile to bacterial habitat. Full-depth hot-mix recycling would be more effective than partial-depth recycling in retarding bacterial decay at cracks.

0206 Health And Safety

REFER ALSO TO CITATION(S) 10713, 10714, 10718

10696 (IT—1987, pp 14) **Operator training - requirements & verification.** Harrison, T. (The Training Group, Inc.). 1987. Infotech, Ste. 200, 1015 Centre St., N., Calgary, Alta., Canada T2E 2P8; $35.00 CAN. (CONF-8706369—; CE—02138).

From Hydrocarbon and chemical plant operations and maintenance; Edmonton, Canada (3 Jun 1987).

In the last five years, numerous changes have put a great deal of pressure on operator training systems. Expectations for improved safety, finer environmental standards and refined operator career progression coincide with budget cuts, early retirements, supervision cuts, corporate restructuring and increased automation. Traditional osmosis approaches to operator training are in difficulty for three major reasons: the rate of learning in these situations is too slow in today's demand; the supervisory back-up which used to cover the learning period has been severely reduced; training must now be complete and documented. The author provides suggestions for improvement of training systems and for detection of training weaknesses. 8 figs.

10697 (IT—1987, pp 18) **Safety in the plant environment.** Duffield, M.T. (Dow Chemical Canada, Inc.). 1987. Infotech, Ste. 200, 1015 Centre St. N., Calgary, Alta., Canada T2E 2P8; $35.00 CAN. (CONF-8706369—; CE—02138).

From Hydrocarbon and chemical plant operations and maintenance; Edmonton, Canada (3 Jun 1987).

Plant safety at Dow Chemical is discussed in this presentation. Specifically focussed are accident/incident investigation, the human element in safety and loss prevention, the responsibilities of employees and employer, safety committees and contractor safety programs. The human element is stressed. 1 fig.

10698 (IT—1987, pp 26) **Technical safety audits related to loss control programs.** Groundwater, C.A.C. (Shell Canada Ltd.). 1987. Infotech, Ste. 200, 1015 Centre St., N., Calgary, Alta., Canada T2E 2P8; $35.00 CAN. (CONF-8706369—; CE—02138).

From Hydrocarbon and chemical plant operations and maintenance; Edmonton, Canada (3 Jun 1987).

The Technical Safety Audit is a proactive method of attempting to reduce incident/accident frequency and severity. In essence, it is a critical examination of a facility carried out by one or more trained and skilled observers whose sole objective is to identify issues and weaknesses in the design and operation which could lead to injury or damage to the public, personnel, equipment, the environment or company viability. The outcome of such an audit is normally a report to management of the facility which outlines in unbiased datail those issues which in the opinion of th auditor(s) may be a threat to the safety of the facility in question. Presented are guidelines for conducting a technical safety audit as well as definition of scope and format. 1 fig.

10699 (IT—1987, pp 12) **Supervisors, safety and the law. What are your responsibilities and liabilities?.** Reid, E. (Edmonton Inspection Branch). 1987. Infotech, Ste. 200, 1015 Centre St., N., Calgary, Alta., Canada T2E 2P8; $35.00 CAN. (CONF-8706369—; CE—02138).

From Hydrocarbon and chemical plant operations and maintenance; Edmonton, Canada (3 Jun 1987).

This arcticle briefly covers the Alberta Health and Safety Act and discusses responsibilities of employers and employees, procedures for entering tanks and vessels, and penalties under the Act.

0207 Marketing And Economics

REFER ALSO TO CITATION(S) 11191

10700 **(DOE/EIA—0109(88/10)) Petroleum supply monthly, October 1988.** (USDOE Energy Information Administration, Washington, DC. Office of Oil and Gas). 23 Dec 1988. 106p. NTIS, PC A06/MF A01 - GPO - OSTI; 1; GPO Dep. Order Number DE89005528/JAW.

Total US demand for petroleum products (measured as product supplied) averaged 17.5 million barrels per day in October 1988, 0.7 million barrels per day above the level for September and 0.5 million barrels per day above the level for October 1987. Total product supplied through the first 10 months of 1988 was 2.4 percent higher than during the same period of 1987. Increased demand for distillate and residual fuel oil together accounted for most of the increase in total product supplied in October 1988. Other highlights for October 1988 include the following: total product stocks decreased 9.8 million barrels to 734.5 million barrels; crude oil stocks, excluding the Strategic Petroleum Reserve (SPR), rose 11.2 million barrels in October to 339.6 million barrels; crude oil imports, excluding SPR, averaged 5.5 million barrels per day, 0.4 million barrels per day above the level for September, this was the highest monthly level since April, 1980; and refinery utilization decreased for the second consecutive month, dropping from 83.7 percent in September to 83.5 percent in October. 12 figs., 8 tabs.

10701 **(DOE/EIA—0380(88/09)) Petroleum marketing monthly, September 1988.** (USDOE Energy Information Administration, Washington, DC. Office of Oil and Gas). 9 Dec 1988. 168p. NTIS, PC A08/MF A01 - GPO - OSTI; 1; GPO Dep. Order Number DE89004558/JAW.

The Petroleum Marketing Monthly (PMM) is designed to give information and statistical data about a variety of crude oils and refined petroleum products. The publication provides statistics on crude oil costs and refined petroleum products sales for use by industry, government, private sector analysts, educational institutions, and consumers. Data on crude oil include the domestic first purchase price, the f.o.b. and landed cost of imported crude oil, and the refiners' acquisition cost of crude oil. Sales data for motor gasoline, distillates, residuals, aviation fuels, kerosene, and propane are presented. 12 figs.

10702 **(DOE/EIA—0380(88/10)) Petroleum marketing monthly, October 1988.** (USDOE Energy Information Administration, Washington, DC. Office of Oil and Gas). 30 Dec 1988. 172p. NTIS, PC A08/MF A01 - GPO - OSTI; 1; GPO Dep. Order Number DE89005526/JAW.

The Petroleum Marketing Monthly is prepared by the Petroleum Marketing Division, Office of Oil and Gas, Energy Information Administration. The Petroleum Marketing Monthly (PMM) is designed to give information and statistical data about a variety of crude oils and refined petroleum products. The publication provides statistics on crude oil costs and refined petroleum products sales for use by industry, government, private sector analysts, educational institutions, and consumers. Data on crude oil include the domestic first purchase price, the f.o.b. and landed cost of imported crude oil, and the refiners' acquisition cost of crude oil. Sales data for motor gasoline, distillates, residuals, aviation fuels, kerosene, and propane are presented. 12 figs., 53 tabs.

0208 Waste Management

REFER ALSO TO CITATION(S) 11260

10703 **(ERACE—7902) Assessment of fiscal instruments available to the federal government which could be used to obtain increases in the quantity of used oil re-refined in Canada.** (E.R.A. Consulting Economists, Inc., Montreal, Quebec (Canada)). 1979. 49p. (CE—02218). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

The percentage of waste oil presently recaptured in Canada is considerably below the accepted potential level. Furthermore, only 12% of the lubricating oil available is re-processed. The re-refining industry in Canada is composed of less than ten geographically dispersed companies, each having a rerefining capability of between 200,000 and 3,000,000 gal/4. These facilities are relatively old and primarily based on the acid/clay process. The price trend of re-refined lubricating oil has paralleled world crude oil prices. Alternate uses of waste oil, for load oiling and as fuel, have seriously hampered the re-refining industry's ability to maintain a steady source of feedstock supply. The geographical dispersion of feedstock, competition for sources of waste oil, the high cost of transport and the low returns on investment of re-refining, as compared to alternate uses of waste oil, are the major constraints to the development of the industry. In addition, the absence of standards and specifications for re-refined oil, the lack of comprehensive legislation among different governments, and general consumer unawareness about re-refined oil, have had a negative impact. The various forms of legislation in force in other countries have been examined. The fiscal instruments that are considered to be most effective, and also applicable to Canada, are the combination of a tax on the producer and an inventive to the re-refiner. The net effect of those instruments serves to provide the re-refiners with the potential to achieve a market price advantage. 1 fig., 2 tabs.

10704 **(PB—89-120828/XAB) EPA's (Environmental Protection Agency's) incineration of an industrial refinery, lagoon sludge using infrared furnace technology.** Oberacker, D.A.; Wall, W.O.; Rosenthal, S. (Environmental Protection Agency, Cincinnati, OH (USA). Hazardous Waste Engineering Research Lab.). Nov 1988. 22p. (EPA—600/D-88/201). NTIS, PC A03/MF A01.

This report briefly presents a case study of a recent field-scale incineration test supported by the U.S. Environmental Protection Agency (EPA) as one of over twenty projects under EPA's Superfund Innovative Technology Evaluation (SITE) program. The purpose of these programs is to encourage demonstration of various innovative techniques for cleaning up polluting hazardous-waste sites in different regions of the country. Presented here is an executive summary of the purpose, the technology used, and a summary of the purpose, the technology used, and a summary of performance results of what will be referred to, henceforth, as the Peak Oil SITE Cleanup Project.

10705 **(TR—7901) Used lubricating oil study. The small user's disposal problem.** Cameron, D.M; Ross, H.J.W. (Turbo Refineries Ltd., Edmonton, Alberta (Canada); Ross Social Surveys, Edmonton, Alberta (Canada)). 1979. 58p. (CE—02196). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

A questionnaire was distributed to approximately 3,000 households in Edmonton and to 230 farms in the St. Paul region to determine lubricating oil purchase and disposal practices. A pilot study was also conducted in both communities to see if people would bring their waste oil to co-operating service stations. Surveys of service stations and of retailers with service departments were conducted, and it was found that all but one retailer and three-quarters of the service stations would accept used oil from motorists who change their own oil. It was concluded that with suitable containers, and the knowledge that these collection sites are available, some of the used oil that is currently being dumped into the environment can be collected. It was estimated that approximately 200,000 gallons of used lubricating oil was disposed of in 1978 in Edmonton by dumping on the ground, pouring down storm sewers, and placing in receptacles for garbage pickup. 4 refs., 2 figs., 4 tabs.

0209 Environmental Aspects

REFER ALSO TO CITATION(S) 10709

10706 **(PB—89-110290/XAB) Regional studies plan, Fiscal Year 1989: final report, Atlantic uter Continental Shelf.** (Minerals Management Service, Vienna, VA (USA). Atlantic OCS Region). 1988. 141p. (OCS/MMS—88/0033). NTIS, PC A07/MF A01.

Report on Offshore Environmental Studies Program. See also PB—87-235511.

Each Fiscal Year the four Regions of the Minerals Management Service, Department of the Interior prepare a studies plan. The purpose of the document is to present the final Atlantic Outer Continental Shelf (OCS) Regional Studies Plan for FY 1989. Each study has a write-up describing the objective, methods, and usefulness of the study results to offshore leasing on the Atlantic OCS. Not every study in the plan may be funded. The 5-year OCS leasing program has been incorporated in establishing the ranking of the studies. Included within the document are the comments and recommendations made on the proposed FY 1989 Atlantic OCS Region studies by the affected Atlantic coastal states.

10707 **(PB—89-114185/XAB) Gulf of Mexico Sales 118 and 122: central and western planning areas. Environmental impact statement (Final).** (Minerals Management Service, Metairie, LA (USA). Gulf of Mexico OCS Regional Office). Aug 1988. 500p. (MMS/GM—88/0044). NTIS, PC A21/MF A01.

See also PB—84-102805. Errata sheet inserted.

This EIS is a description of the environmental aspects and impacts of oil and gas activities resulting from the lease sale or the states bordering the Gulf of Mexico. It provides a description of the area, affected environment, and environmental consequences; it discusses the proposed action, issues and areas of concern, and the major differences of holding the lease sale.

10708 **(PB—89-117451/XAB) Synthesis of effects of oil on marine mammals. Final report, 1986-1988.** Geraci, J.R.; St, D.J. (Battelle Memorial Inst., Ventura, CA (USA)). Sep 1988. 304p. NTIS, PC A14/MF A01.

The report completes the synthesis of existing information on the effects of oil, dispersed oil, oil dispersants, and oil-cleaning agents on marine mammals which migrate through or inhabit U.S. Outer Continental Shelf (OCS) planning areas. The report will be used to produce a manuscript for use in OCS decision making and serve as a general-reference document for parties interested in marine mammals and oil-effects research. A literature search on foreign and non-foreign literature, was conducted on topics pertaining to the natural history and oil, oil dispersant, and oil-cleaning agents effects to marine mammals.

0210 Legislation And Regulation

10709 **(ERCB/C—D88-15) Westhill resources application for well licences Acheson East Field.** (Energy Resources Conservation Board, Calgary, Alberta (Canada)). 1988. 12p. (CE—02140). Energy Resources Conservation Board, 640-5th Ave. SW, Calgary, Alta., Canada T2P 3G4; $5.00 CAN.

A public hearing was held in the city of Edmonton before the Alberta Energy Resources Conservation Board to consider applications for licenses for oil wells. A number of landowners and businesses were opposed to the applications, based primarily on concerns that the appearance of the proposed wells and the possibility of hydrogen sulfide discharges would have an adverse effect on property development and value, and might pose a risk to existing facilities. After considering the purpose and need for the wells, the conflict of land use and the surface location of the wells, the impact of the wells, and public safety, the Board approved the applications. Approval was contingent on the applicants' implementation of measures outlined at the hearing for minimization of impacts from the wells. Approval was also made subject to the conditions that the well site and production facilities be enclosed in a suitable enclosure, and that all pump motors be electrically driven. 1 fig.

10710 **(NEI-DK—114) Exploration. Guidelines for drilling.** (Energistyrelsen, Copenhagen (Denmark)). Sep 1988. 72p. (In Danish, English). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88755795/JAW.

These guidelines apply to approval and supervision, which in consequence of the Danish subsoil Act have been delegated to the Danish Energy Agency. Chapter 1 relates to exploration and appraisal wells for hydrocarbons and other minerals, offshore and on land as specified in Section 1 of the subsoil Act. However, some specifications have specific relevance for offshore wells or wells drilled to hydrocarbon targets, and may to a certain degree be irrelevant for other purposes. It must be noted that specifications are given as guidance and that other means of achieving corresponding conditions regarding safety and information might be approved.

0220 Transport, Pipelines, And Handling

REFER ALSO TO CITATION(S) 10686, 10687

0230 Properties

REFER ALSO TO CITATION(S) 10638

10711 **(ICES-CRR—117) Report on the first ICES intercomparison exercise on petroleum hydrocarbon analyses in marine samples.** (International Council for the Exploration of the Sea, Copenhagen (Denmark)). Nov 1982. 58p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88755768/JAW.

An intercomparison of petroleum hydrocarbon analyses has been conducted for samples of crude oil, marine sediment and mussel homogenate. Thirty-six sets of samples were distributed and results have been submitted by twenty-six laboratories in eleven countries. No analytical techniques were specified for the exercise, and analyses by gravimetry, infrared and ultraviolet spectrophotometry, fluorescence spectroscopy, gas and liquid chromatography, and combined gas chromatography/mass spectrometry were reported. A reasonable agreement was obtained between laboratories for broad fraction analysis, but the determined concentrations of specific hydrocarbons showed greater variation. Proposals are made for the general lines of a follow-up exercise.

0250 Combustion

REFER ALSO TO CITATION(S) 10718

10712 **(NEI-FI—48) Combustion of water/heavy fuel oil emulsions in Finland.** Kaukainen, E.; Pyykkoenen, A.; Larnimaa, K. (Enconsults Oy, Kaarina (Finland)). 1987. 68p. (In Finnish). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88755810/JAW.

The report deals with the use of the water/oil emulsion technique in Finland. About a half of the 500-600 oil fired boilers are equipped with the water/oil emulsion system. Most of the water/oil emulsion installation are in boilers smaller than 5 MW. Practical experience of the emulsion systems was studied by collecting data from 105 installations. Most of the users were satisfied with their water/oil emulsion equipments. The water/oil emulsion combustion was reported in general to give less particulate emissions and to reduce to fauling of the boiler. The problems were mostly connected to equipment malfunctions caused by too long service intervals. Also some reported problems caused by a new, thinner but less friable type of soot and ash deposits on the heat transfer surfaces. The report also gives paticulate emissions data from around 60 boilers with water/oil emulsion system. The average particulate emission from boilers run without the water/oil emulsion system was 340 mg/m/sup 3/, while the corresponding average figure was 150 mg/m/sup 3/ for units operated with the water/oil emulsion system. Thus the material gives an average decrease of 5% for particulate matter due to the water/oil emulsion system.

10713 **(STF—15A88014) IEA working party on "Conservation in combustion". Contributions from 1982 to 1987.** Hustad, J.E.; Soenju, O.K. (Selskapet for Industriell og Teknisk Forskning, Trondheim (Norway)). May 1988. 61p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88755894/JAW.

The report represents the summary of contributions to the IEA working party on "Conservation in combustion" from 1982 to 1987, except for the year 1985. The presented papers cover the following aspects: Experimental study of turbulent flames; experimental study of turbulent jet diffusion flames; radiation and size scaling

of large gas/oil diffusion flames; total heat flux to pipes submerged in turbulent jet diffusion flames. Separate abstracts are prepared for each paper. 35 figures, 2 tables, 22 references.

10714 (STF—15A88014, pp 25-36) **Radiation and size scaling of large gas/oil diffusion flames.** Hustad, J.E.; Soenju, O.K. May 1988. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88755894/JAW.

In IEA working party on "Conservation in combustion". Contributions from 1982 to 1987.

This paper includes experimental data for large turbulent diffusion flames in oil/gas mixtures released from straight tubes at up to sonic velocities at atmospheric pressure. Experiments have been performed on large turbulent flames of oil/propane mixtures issuing from circular nozzle geometries into quiescent air at atmospheric pressure and temperature. The release tube diameters were between 10 and 33 mm. The jet exit Mach numbers were between 0.03 and unity, resulting in calculated heat release rates up to 7.5 MW and in observed flame heights up to 8 m. Measurements of the flame heights and diameters and radiative energy flux profiles were made. It is found that the flame height and diameter scale approximately with a corrected Froude number where the increase in jet momentum caused by the oil was taken into consideration. The average radiation flux from the flame was found to increase linearly with the flame height when the flame shape was approximated by a cylinder. The radiation increases with increasing amount of oil in the gas. An estimated 22-34 % of the total heat release was radiated depending on the conditions. 5 figures, 1 table.

03 NATURAL GAS

REFER ALSO TO CITATION(S) 11718

0302 Geology And Exploration

REFER ALSO TO CITATION(S) 10684, 10685, 10710

0303 Drilling, Production, And Processing

REFER ALSO TO CITATION(S) 10687

10715 **(STF—21A87041) Natural gas refining. Selective extraction of ethylene.** Andersen, M.S. (Selskapet for Industriell og Teknisk Forskning, Trondheim (Norway)). Mar 1987. 110p. (In Norwegian). NTIS (US Sales Only), PC A06. Order Number DE88755896/JAW.

The report deals with a literature study on the selective extraction of ethylene in connection with natural gas refining. The various extraction methods are analysed, and the absorption of olefins or olefins/carbon monoxide mixture in silver- or copper salt solutions seem to be the preferred methods in this connection. In the silver salt solutions the olefins only are absorbed, and in the major solutions of copper salts both olefins and carbon monoxide are absorbed. The extraction of carbon monoxide from carbon monoxide/ethylene mixtures is discussed. 2 figures, 6 tables, 29 references.

0305 Health And Safety

REFER ALSO TO CITATION(S) 10714, 10737

10716 **(PB—89-131064/XAB) Evaluation of low-cost gas-sensor technology. Phase 1. Final report, January-April 1986.** Clifford, P.K.; Dorman, M.G. (Mosaic Industries, Inc., Mountain View, CA (USA)). Jul 1986. 84p. (M—8601-1). NTIS, PC A05/MF A01.

See also Phase 2, PB—89-131072.

The results of Phase 1 of an investigation of the use of low-cost gas detection and alarm instruments by utilities throughout the world are reported. Because Japan stands out as the only country in the world that has established a mass market for domestic and commercial gas-leak alarms, incomplete combustion monitors, and automatic gas shutoff systems, the Phase 1 report focuses on the use of these systems by the Japanese gas utilities. It describes the sensor technologies used, the features and performance of the presently available gas alarms and detection instruments, the number in use, and their effectiveness in improving the safety of gas consumption. In addition, it examines the influence of government regulations on the design and marketing of gas leak alarms, describes the role of the utilities in marketing gas safety devices, evaluates the state of development of presently used sensors, and summarizes current industrial and university gas sensor research programs to provide a view of the improvements in the state of the art that are expected in the near future. Phase 2 (PB89-131072) explores the status of world wide research in low-cost gas-sensor technology.

10717 **(PB—89-131072/XAB) Evaluation of low-cost gas sensor technology. Phase 2. Final report, June-September 1986.** Clifford, P.K.; Dorman, M.G. (Mosaic Industries, Inc., Mountain View, CA (USA)). Jan 1987. 42p. (M—8601-2). NTIS, PC A03/MF A01.

See also Phase 1, PB—89-131064.

The study (Phase 2) explores the status of world-wide research and development in gas-sensor technology, including progress made by European researchers. Its focus is the Second International Meeting on Chemical Sensors held in Bordeaux, France, on July 7-10, 1986. The purpose of the study was to summarize and assess research trends and technological progress in the gas-sensor field with a view to their potential application to the needs of the US gas utility industry for low-cost CO, methane, and NOx detection. Phase 1 (PB89-131064) focuses on the practical use of low-cost gas-leak alarms, incomplete-combustion monitors, and smart gas meters by gas utilities in Japan.

10718 (STF—15A88014, pp 1-4) **Experimental study of turbulent flames.** Soenju, O.K. May 1988. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88755894/JAW.

In IEA working party on "Conservation in combustion". Contributions from 1982 to 1987.

The paper deals with an experimental study of turbulent flames. The main objective of this work is to obtain experimental data for large turbulent diffusion flames for liquid and gaseous fuels released from straight tubes and some other geometries. The goal is to establish approximate scaling laws for these flames and also to compare with results of detailed numerical analysis. This study is part of a program aimed at assessing the fire hazards and damage potential connected with industrial gas, oil/gas - leakages and blow-out situations connected with offshore oil and gas exploration. 3 figures.

10719 (STF—15A88014, pp 38-55) **Total heat flux to pipes submerged in turbulent jet diffusion flames.** Hustad, J.E.; Soenju, O.K. May 1988. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88755894/JAW.

In IEA working party on "Conservation in combustion". Contributions from 1982 to 1987.

The paper deals with the total heat flux to pipes submerged in turbulent jet diffusion flames. Accidental leakages of gases from flanges or ruptures in pipes can be ignited and cause large damages in process plants both offshore and onshore. Structural elements can be submerged in such flames being subject to large heat fluxes. Experimental studies of total heat transfer to a pipe submerged in impinging jet flames are performed. A copper heat flux probe is developed and inserted into a 50 mm diameter steel pipe for measuring total heat transfer from such impinging jet flames. The heat fluxes to the pipe from flames from propane and methane released from circular tubes into quiescent air are measured and traverses both in vertical and horizontal directions within the flames are made. 9 figures.

0306 Marketing And Economics

REFER ALSO TO CITATION(S) 10734, 11191

10720 (CPA—1987, pp 10) **Production valuation.** Graff, C.A. (C.A. Graff & Associates Ltd.). 1987. Canadian Petroleum Association, 3800 150 6th Ave. S.W., Calgary, Alta., Canada. (CONF-8703308—; CE—02137).

From Gas deregulation - administrative and accounting impacts; Calgary, Canada (3 Mar 1987).

The valuation of natural gas relative to the producer owning the product from the wellhead to the point of sale has changed dramatically with deregulation. The purposes of this paper are to identify that the principal concern of product valuation is from a corporate revenue perspective and to identify a number of complex considerations which must be addressed in determining net unit prices at the plant gate. The considerations are in no way exhaustive but are intended to stimulate the need for valuation policies and procedures which must be developed to address Corporate, Industry Partnership and Royalty concerns. They are fair value, environment changes, company versus partner operated facilities, point of sale, end use, type of sale, gross values, netback maximization, inventories and allowable deductions from gross and net unit values.

10721 (CPA—1987, pp 13) **Deregulation and its impact on straddle plant accounting.** Letwin, S.J. (Encor Energy Corporation, Inc.). 1987. Infotech, Ste. 200, 1015 Centre St., N., Calgary, Alta., Canada. (CONF-8703308—; CE—02137).

From Gas deregulation - administrative and accounting impacts; Calgary, Canada (3 Mar 1987).

Straddle plants are tied into gas pipeline transmission systems and utilize turbo-expansion as one of the methods of extracting natural gas liquids from natural gas. They will become a key interface for direct gas sales especially as it relates to the definition of a sales point for royalty calculation purposes. This paper describes the straddle plant process and the implications for accounting that accompany deregulation. 9 figs.

10722 (CPA—1987, pp 23) **Transportation on the distributor's system.** Hunter, J.C. (Union Gas Ltd.). 1987. Infotech, Ste. 200, 1015 Centre St., N., Calgary, Alta., Canada. (CONF-8703308—; CE—02137).

From Gas deregulation - administrative and accounting impacts; Calgary, Canada (3 Mar 1987).

Since the advent of the October Natural Gas Agreement in 1985, many significant events have taken place which have had an impact on the six key players in the natural gas industry: the producer, Nova, TransCanada Pipelines, the distributor, the end user, and regulatory agencies. For the first time on a large scale, producers are dealing directly with end users of natural gas, while at the same time still requiring use of the transportation infrastructure, which in turn involves interfacing with regulatory bodies. To protect contract integrity and minimize his risk, it is essential that the producer understand the financial and operation constraints of the various parties involved. The author gives an overview of a distributor's system, the types of direct purchase involved, their impact on the direct purchasers, the distributor, and the producer, and outlines the risks to which the unwary producer may subject himself. Discussions of regulatory financial, and operational risk will merge with particular emphasis on the interface between the end user, the distributor, and the producer. 2 figs.

10723 (CPA—1987, pp 23) **Export transportation - Canada and the United States.** Douloff, A. (TrnasCanada Pipelines). 1987. Infotech, Ste. 200, 1015 Centre St., N., Calgary, Alta., Canada. (CONF-8703308—; CE—02137).

From Gas deregulation - administrative and accounting impacts; Calgary, Canada (3 Mar 1987).

The deregulation of natural gas markets in Canada , a process set in motion by the 1985 Natural Gas Agreement, has forced those in the industry to realign operations to meet the new challenges. There has been a redistribution of services with direct purchasers displacing previous sales volumes with transporation volumes. This redistribution has brought with it several attendant problems for TransCanada. However, the difficulties experienced by TransCanada during 1986, the transition year, can also be seen as resulting from the fact that TransCanada has been forced into a role for which it was neither intended to be cast nor ever rehearsed - that of a distributor. As a result of experiences during the past year TransCanada has proposed a means of enhancing open access to its system. What is suggested is termed umbrella t-service. This would preserve TransCanada's traditional role as a transmission company, reduce burgeoning customer base and, consequently, lower administrative cost. This paper discusses changes in TransCanada Pipeline's adminstration and accounting operations, reviews deregulation and suggests changes in relationships with distributors. 8 figs.

10724 (CPA—1987, pp 18) **Transportation in Alberta.** Schmidt, R.W. (Alberta Gas Transmission Division, Nova). 1987. Infortech, Ste. 200, 1015 Centre St., N., Calgary, Alta., Canada. (CONF-8703308—; CE—02137).

From Gas deregulation - administrative and accounting impacts; Calgary, Canada (3 Mar 1987).

Deregulation of the gas marketplace is having a significant impact on the transportation services provided by Nova. The dramatic increase anticipated in customers and contracts has resulted in a change to a two-part, demand/commodity rate from a pure commodity rate. In addition to reviewing the reasons for the change in Nova's rates, the paper also discusses the nomination procedures and the methods of inventory control on the pipeline system. The balancing of receipts to deliveries on a daily and monthly basis is further complicated by the increasing number of customers and contracts.

10725 (CPA—1987, pp 17) **Customers and trends.** Reinwart, W.C. (PanCanadian Petroleum Ltd.). 1987. Infotech, Ste. 200, 1015 Centre St., N., Calgary, Alta., Canada. (CONF-8703308—; CE—02137).

From Gas deregulation - administrative and accounting impacts; Calgary, Canada (3 Mar 1987).

This paper briefly reviews the forces that have been at work in the gas market from the producer's point of view, by noting natural gas supply/demand comparisons and field prices in Canada and the United States. The author looks at the industry structure, some general aspects of natural gas deals under deregulation, and concludes with personal observations on some points to consider for the future. The need for cooperation within the industry and the need for an active and financially healthy natural gas producing industry are stressed. 4 figs.

10726 (CPA—1987, pp 22) **Sales contracts.** Sinclair, S.W. (Canadian Worldwide Energy Ltd.). 1987. Infotech, Ste. 200, 1015 Centre St., N., Calgary, Alta., Canada. (CONF-8703308—; CE—02137).

From Gas deregulation - administrative and accounting impacts; Calgary, Canada (3 Mar 1987).

Gas contracts are more complicated not only due to deregulation but the fall in gas prices have made all gas producers pay more attention to details. This paper briefly describes the types of sale contracts under deregulation and how a modern direct sale is negotiated. It includes a discussion of accounting steps to be performed each month and highlights items which require special attention in administrating and accounting for direct sale contracts.

10727 (CPA—1987, pp 13) **Gas deregulation impacts on joint ventures.** Arnason, L. (Cooperative Energy Development Corp.). 1987. Infotech, Ste. 200, 1015 Centre St., N., Calgary, Alta., Canada. (CONF-8703308—; CE—02137).

From Gas deregulation - administrative and accounting impacts; Calgary, Canada (3 Mar 1987).

Gas deregulation has drastically changed business conduct at every internal level and with other companies. Specific administrative problems in joint interest areas put these supplies at a disadvantage to wholly-owned supplies. The fundamental problem arises in applying independent contracts with widely varying nominations to existing contractual relationships with their inherent limitations and obligations. These relationships often appear inconsistent with the intent of deregulation. The purpose of this paper is to investigate some of the effects that gas deregulation is having on joint operations, flag some potential administrative problems, and point to possible solutions.

10728 (CPA—1987, pp 12) **Gas deregulation - accounting and administrative issues.** Collins, T.M. 1987. Infotech, Ste. 200, 1015 Centre St., N., Calgary, Alta., Canada. Order Number TI88116083/JAW. (CONF-8703308—; CE—02137).

From Gas deregulation - administrative and accounting impacts; Calgary, Canada (3 Mar 1987).

The author discusses aspects of natural gas deregulation, particularly the administrative and accounting policy issues which have arisen as a result of deregulation. Background on deregulation, its impacts, and some gas royalties issues are identified.

10729 (CPA—1987, pp 11) **Monitoring and reporting.** Thomas, V.M. (Alberta Petroleum Marketing Commission). 1987. Infotech, Ste. 200, 1015 Centre St., N., Calgary, Alta., Canada. Order Number TI88116083/JAW. (CONF-8703308—; CE—02137).

From Gas deregulation - administrative and accounting impacts; Calgary, Canada (3 Mar 1987).

During the pre November 1, 1986 period of regulated pricing for Alberta natural gas, the Alberta Petroleum Marketing Commission collected certain information relative to gas pricing and production primarily through buy/sell transactions under the Natural Gas Pricing Agreement Act. For purposes of royalty verification, market analyses and policy evaluation, the Alberta government, through the Commission, will continue to gather information effective November 1, 1986 pursuant to the Natural Gas Marketing Act. This paper describes the requirements under the Act for specific persons to report natural gas activities to the Commission and outlines the categories of information to be supplied.

10730 **(CPA—1987) Gas deregulation - administrative & accounting impacts.** (Canadian Petroleum Association, Calgary, Alberta). 1987. 148p. (CONF-8703308—; CE—02137). Infotech, Ste. 200, 1015 Centre St.,N., Calgary, Alta., Canada T2E 2P8; $40.00 CAN.

From Gas deregulation - administrative and accounting impacts; Calgary, Canada (3 Mar 1987).

This conference highlights the effects of deregulation on contract management, supply/demand, industry relationships and pricing of natural gas. Separate abstracts were prepared for ten papers.

10731 **(DOE/EIA—0130(88/10)) Natural gas monthly, October 1988.** (USDOE Energy Information Administration, Washington, DC. Office of Oil and Gas). 23 Dec 1988. 144p. NTIS, PC A07/MF A01 - GPO - OSTI; 1; GPO Dep. Order Number DE89005517/JAW.

The Natural Gas Monthly (NGM) is prepared in the Data Operations Branch of the Reserves and Natural Gas Division, Office of Oil and Gas, Energy Information Administration (EIA), US Department of Energy (DOE). The NGM highlights activities, events, and analyses of interest to public and private sector organizations associated with the natural gas industry. Volume and price data are presented each month for natural gas production, distribution, consumption, and interstate pipeline activities. Producer related activities and underground storage data are also reported. From time to time, the NGM features articles designed to assist readers in using and interpreting the natural gas information. 6 figs., 34 tabs.

0308 Environmental Aspects

REFER ALSO TO CITATION(S) 10706, 10707, 11312

10732 **(CU/KC—1988) Reclamation of sulphur block basepads.** Parkinson, D.; Leggett, S. (Calgary Univ., Alberta (Canada). Kananaskis Centre for Environmental Research). 1988. 54p. (MICROLOG—88-04777). Environment Canada, Document, Text and Library Services, Terrasses de la Chaudiere, 10 Wellington St., Ottawa, Ont., Canada K1A 0H3; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

Alberta sour gas plants, which produce elemental sulfur from the H/sub 2/S in the gas, have stored excess sulfur by pouring the molten form into a large block, on top of a base pad often also made of sulfur. Cleanup and reclamation of soil located below former sulfur basepads and blocks is a required to prevent generation of excess soil acidity. In this paper, reclamation potential of contaminated soil from beneath a sulfur block basepad was evaluated in greenhouse trials. The effect of lime and/or manure additions to pots of soil containing 4 different levels of total S was tested through characterization of soil and leachate chemistry and growth of reed canarygrass. Unamended soils were acidic and contained high levels of soluble salts and available ammonium. Lime addition to sulfur-contaminated soils resulted in the maintenance of a neutral soil pH throughout the experiment and decreased extractable phosphorus levels. Manure amendation did not significantly increasse soil pH. Leachates produced from pots containing acid soils were acidic, while those produced from neutralized soils were neutral. No plant growth occcurred in pots containing unamended, sulfur-contaminated soil. Lime applications were not effective in promoting plant growth at soil S levels above 4%. This may be due to pore space reduction due to the physical presence of the lime. Soils amended with manure alone did not produce any plant growth. Soils contaminated with elemental S should be treated with smaller initial lime applications over an extended time period than is currently practised. Prompt liming of soils contaminated with elemental S is, however, recommended to minimize acidic leachate production. 31 refs., 20 tabs.

0310 Legislation And Regulation

REFER ALSO TO CITATION(S) 10710

10733 **(NEB-SS—NE221-1/1988-7E) Reasons for decision in the matter of Canadian Hunter Exploration Ltd. Application pursuant to Part VI of the National Energy Board Act for a licence to export natural gas.** (National Energy Board, Ottawa, Ontario (Canada)). Aug 1988. 8p. (CE—02040). National Energy Board, Trebla Bldg., 473 Albert St., Ottawa, Ont., Canada K1A 0E5; $N/C.

An application was made before the National Energy Board of Canada for approval of a license to export natural gas through Ontario to the USA. The customer in the USA will use the gas to fuel a new cogeneration facility to be constructed in Syracuse, NY which will produce electricity to be sold to a utility and steam to be sold to various institutional customers in the surrounding area. An export impact assessment was performed, and indicated that the proposed annual export volumes were small compared to Canada's supply and requirements, and should have little impact on Canadian production, consumption and prices of natural gas. The Board also examined the contracts executed by the applicant and various customers in the USA. A unique aspect of the gas sales agreement is an up-front payment of $70 million (US), a pricing provision intended to provide a measure of cost certainty to the institutions financing the project. Another feature of the agreement is that it allows for interruptible transportation in both the USA and Canada in the event that firm transportation is not available. The Board also examined the gas supply available to the applicant and was satisfied that adequate gas supplies will become available to meet the requirements of the gas sales agreement. In addition, the applicant's cost-benefit analysis of the proposed gas export sale is discussed. A license was issued to export at total of 3,381 million m/sup 3/ of gas from 1990 to 2010.

0320 Transport, Pipelines, And Handling

REFER ALSO TO CITATION(S) 10687, 10733

10734 **(DOE/EIA—0145(87)) Statistics of interstate natural gas pipeline companies 1987.** (USDOE Energy Information Administration, Washington, DC. Office of Oil and Gas). 30 Dec 1988. 233p. NTIS, PC A11/MF A01 - GPO - OSTI; 1; GPO Dep. Order Number DE89005525/JAW.

The Statistics of Interstate Natural Gas Pipeline Companies 1987, presents financial and operating information of all major interstate natural gas pipeline companies that operated in the United States during 1987. This report is used by the Federal Energy Regulatory Commission (FERC), state utility commissions, other government agencies, and the general public. The information is taken from FERC Form 2, "Annual Report of Major Natural Gas Companies," as filed with the Federal Energy Regulatory Commission. 5 figs., 29 tabs.

10735 **(NEI-DK—121) Moving finite element simulation of compressible natural gas flow in pipelines.** Hansen, J.A. (Danmarks Tekniske Hoejskole, Lyngby. Institut for Kemiteknik). May 1987. 334p. NTIS (US Sales Only), PC A14/MF A01. Order Number DE88755802/JAW.

The background for the present work is the need for simulation of gas flow in pipelines. The increasing exploitation of offshore oil and gas has raised a strong demand for improved calculation methods for analysis and design of pipeline systems. Reliable predictions of essential physical variables like pressure, flow rate, temperature and density are required for improving the design basis. Similarly, the operation of the pipeline could be improved and automated. Another aspect is the need for leak-control caused by the everincreasing concern about factors such as environment, safety and product-loss. The present work is concentrated on development of numerical methods for simulation of transient gas flow in pipelines with special emphasis upon resolution of fast transients such as shocks. Special numerical methods are needed for such problems. The adaptive methods are suited for these kind of problems. In this thesis we have developed a Moving Finite Element Method (MFEM) for the simulation of gas flow in pipelines. Finally Chapter 8 summarises the results of the work with the MFEM methods, and future work is discussed. Various inner products arising from the MFEM method are given in Appendix A. Some results from the simulations performed in Chapter 5 are presented in Appendix B. Several different flow situations have been simulated, these include changes in both pressure and flow rate at the inlet and at the outlet of the pipe. The programme is able to reach a steady state flow condition if the boundary conditions are kept constant. The developed ODE-solver is very robust, and the new implementation concepts have improved the efficiency. 122 refs. (SM).

0340 Combustion

REFER ALSO TO CITATION(S) 10713, 10714, 10718, 10967

10736 **(CU/ME—1980) The efficient utilization of low heating value fuels.** Karim, G.A. (Calgary Univ., Alberta (Canada). Dept. of Mechanical Engineering). 1980. 17p. (CE—02135). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

A research project was undertaken to investigate the combustion of low heating value fuels, the burners and combustors used with such fuels, and possible improvements in the combustion and utilization of such fuels. Project activities included literature searches, computer modelling of chemical kinetics, and attempts to predict variations in the flammability limits of fuel-air mixtures; the latter activity receives special attention in this report. It was seen that the definition of flammability limit in the literature was insufficiently precise, and this project emphasized the need to consider the limit on a probabilistic basis. Also, considering the limit on the basis of a limiting heating value was found to be inadequate, as the flammability limit also depends on the nature and concentration of the diluent present with the fuel. A satisfactory hypothesis for determining the flammability limit was then formulated. Significant improvements in flammability were obtained by adding even a small amount of hydrogen to the gas mixtures, and by providing adequate heat transfer to the combustion zone, for example by preheating the fuel/air mixture. In examining the prediction of the flammability limit of a fuel mixture in air from the corresponding flammability limits of the components making up the fuel mixture, LeChatlier's approach was found to be adequate if no direct information is available. As part of the research into utilization of low heating value fuels, work was done on burner designs that would take into account some of the above findings and would enhance flame stability with minimum use of auxilliary fuels. 4 figs.

10737 (STF—15A88014, pp 5-12) **Experimental study of turbulent jet diffusion flames.** Soenju, O.K.; Hustad, J. May 1988. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88755894/JAW.

In IEA working party on "Conservation in combustion". Contributions from 1982 to 1987.

This paper reports experimental data for large turbulent diffusion flames for gaseous fuels released from straight tubes at up to sonic velocities at atmospheric pressure. The goals of the work have been to establish approximate correlations and scaling laws for these flames, to compare with results available in the literature and to contribute to the understanding of flame structure and liftoff mechanisms. This study is part of a program started in 1979 aimed at assessing the fire hazards and damage potential connected with industrial gas releases and gas and oil/gas releases and blow-out situations related to offshore oil and gas exploration. Experiments have been performed on turbulent flames of methane and propane, issuing from jets into quiecent air at atmospheric pressure and temperature for both small-scale laboratory flames and larger flames during field tests. 6 figures.

0350 Storage

10738 **(ORNL/Sub—85-22025/1) Evaluation of the effects of natural gas contaminants on corrosion in compressed natural gas storage systems: Phase 2.** Lyle, F.F. Jr. (Oak Ridge National Lab., TN (USA); Southwest Research Inst., San Antonio, TX (USA)). Jan 1989. Contract AC05-84OR21400. 60p. NTIS, PC A04/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005712/JAW.

This report describes a research program that was conducted to define natural gas contaminant levels necessary to insure that internal corrosion of compressed natural gas (CNG) cylinders does not constitute a hazard over the lifetimes of the cylinders. A literature search was performed and companies in the natural gas transmission and distribution industries were contacted: to identify and determine the composition ranges of contaminants in natural gases; and to obtain information regarding corrosion damage of CNG cylinders and cylinder materials. Corrosion and stress corrosion cracking (SCC) tests were performed on the cylinder materials most widely used in CNG cylinders in the United States (413OX and 15B30 steels and 6061-T6 aluminum alloy). Tests were conducted in: natural gases from several producing wells and from an interstate pipeline; and in aqueous solutions saturated with varying concentrations of natural gas contaminants. Also, metallurgical analyses of nine (eight steel and one aluminum) used CNG cylinders were performed. 12 refs., 7 figs., 7 tabs.

04 OIL SHALES AND TAR SANDS

0404 Oil Production, Recovery, And Refining

REFER ALSO TO CITATION(S) 10610, 10611, 10616

10739 **(GCLL—8803) Development and evaluation of catalysts for hydrogenation of raw Cold Lake pitch.** Pandey, R.N. (Guelph Cehmical Labs., Ontario (Canada)). 1988. 330p. (MICROLOG—88-05001). Canada Centre for Mineral and Energy Technology, Technical Information Division, 555 Booth St., Rm. 342, Ottawa, Ont., Canada K1A 0G1; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

Flash hydropyrolysis offers significant advances in technique over conventional processes for conversion of residual materials such as pitch. The process is based on fast heating rates and short residence time during the reaction of hydrogen with aromatics in the asphaltene and maltene fractions of the residuals. In this research, hydrogenation of Cold Lake pitch was studied over various catalysts impregnated with nitrates and phosphoric acid. Typical flash hydropyrolysis of pitch produces a wide range of gaseous and liquid products. The catalysts were found active and yielded gaseous and hydrogenation products in significant amounts and with significantly less char formation compared to non-catalytic reactions. The effects of process variables (temperature, heating rate, hydrogen pressure, vapor residence time, and catalyst/pitch weight ratios) were also studied, and temperature vs time profile curves were constructed. A gas chromatograph provided quantitative analyses of the low boiling distillates and gases. A simulated distillation

of the heavy distillate was performed by gas chromatography according to ASTM standard D2887. Zinc chloride was found to be the best among the catalysts examined, yielding lower char values, lower gaseous products and desirable boiling range distillates. Using that catalyst, the highest carbon conversion of pitch to light products was ca 93 wt%, corresponding to 7 wt% carbon as char. 85 refs., 114 figs., 38 tabs.

0405 Properties And Composition

REFER ALSO TO CITATION(S) 10638, 11483

10740 **(ACI—88-12) Bench-scale benefication tests of New Brunswick oil shale.** White, J.; O'Donnell, R.; Slaunwhite, H.; Birk, D. (Atlantic Coal Inst., Sydney, Nova Scotia (Canada)). 1988. 281p. (MICROLOG—88-05302). New Brunswick Dept. of Natural Resources and Energy, P.O. Box 6000, Fredericton, N.B., Canada E3B 5H1; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

Oil shales from the Albert Formation were studied to determine their beneficiation potential. Attempts were made to concentrate the organic-rich fraction (for retorting) and a carbonate-rich fraction (to act as a sulfur scavenger when co-combusted with coal). A scanning electron microscope was used to characterize the mineral assemblages present in the oil shale. Manual analysis showed the distinct varved nature of these shales with an abundant mineral-rich fraction and a less common organic-rich fraction. Automated analysis identified the major mineral groups. Heavy media float-sink analyses exhibited significant decreases in organic matter and increases in carbonate content as the specific gravity of the fluid increased. These trends were moderated, however, when weight recoveries were considered. Froth flotation tests also concentrated an organic fraction, but with low recoveries. Finer grinding of flotation samples did not improve concentrations possibly due to the interference of fine carbonate materials. Carbonate minerals also appeared to interfere with oil agglomeration tests. A separation of organics and carbonates occurred in the air classification tests, but recoveries were too low to be of any significance. Magnetic separation tests and jigging tests were unsuccessful. Concentrating table testing proved to be the most successful technique to concentrate a carbonate-rich tails fraction. The carbonate content of the Albert shale may have a detrimental effect on attempts to upgrade the organic fraction. Thus, removal of the carbonate-rich fraction by way of tabling or float-sink analysis prior to flotation or agglomeration tests may provide more encouraging results. 36 refs., 91 figs., 167 tabs.

10741 **(ARC/CR—YCLQ-22) Simulated distillation by gas chromatography. Part 1.** Southern, T.; Selucky, M. (Alberta Research Council, Edmonton (Canada). Coal Research Dept.). 1983. 49p. (CE—02166). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

The procedure for simulated distillation by gas chromatography (GC) is derived from the proportionality relation of the boiling points of non-polar compounds and GC retention time on a non-polar column. The peak-identification and evaluation of the chromatogram can provide a boiling point distribution curve. One of the problems of simulated distillation by gas chromatography is the correct determination of the analysis baseline. The first step in this project was the study of the various factors influencing baseline variability. Two programs written in BASIC have been developed for baseline treatment, and program listings are included. In this report, chromatographic results of simulated distillation are evaluated, and the influence of baseline treatment on the results determined. Gas chromatographic results were compared for the Athabasca bitumen-derived gas oil with results of spinning band distillation done on the same sample elsewhere. Repeatability (standard deviation) of this type of simulated distillation was also examined. Typically, for Saarbergwerke solvent, the standard deviation for initial and final boiling points was found to be 0.2/sup 0/C and 0.9/sup 0/C respectively while intermediate fractions were repeatable to 0.4/sup 0/C. Day-to-day repeatability was checked and found to be within these same limits. This type of baseline treatment gives satisfactory results in the low boiling range of the chromatogram, but results for high-boiling components (above ca 360/sup 0/C) should be improved. The present programs permit comparative evaluation of coal liquids from different process types based on simulated distillation. 6 figs., 5 tabs.

05 NUCLEAR FUELS

REFER ALSO TO CITATION(S) 10983, 12462

0504 Feed Processing

10742 **(CEA-CONF—9564) Analysis of the extraction kinetics of uranium by tributyl phosphate, application to the use of pulsed columns.** Dinh, B. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Genie Radioactif). 1988. 3p. (CONF-8807136—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88756222/JAW.

From ISEC '88: international solvent extraction conference; Moscow, USSR (18 Jul 1988).

The experience gained in the operation of pilot plants for the extraction of uranyl nitrate by tributyl phosphate in pulsed columns indicates that the mechanism limiting the transfer kinetics is important for the control of transfer performance. While it is commonly acknowledged that the chemical mechanism of transfer (complexation of uranyl nitrate by tributyl phosphate) is interfacial and of the first order with respect to uranium, opinions are divided as to whether it is actually the limiting step in the transfer kinetics. By considering basically that these two steps in the transfer can play an equivalent role, we employed the single drop technique, in a stationary medium or one subjected to a pulsation, to determine the conditions in which one or the other of these two steps was limiting.

10743 **(IPEN-Pub—132) Recent advances and actual status of actinides and Lanthanides research at the IPEN-CNEN/Sao Paulo, Brazil.** Abrao, A. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo, SP (Brazil)). Jan 1988. 10p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704151/JAW.

This paper focuses on the experience acquired with the operation of a pulsed columns solvent extraction unit for the refining of yellowcake produced from the industrial treatment of monazite sand, and the further experimental production of ammonium diuranate, uranium oxides, uranyl tricarbonate and tetra-and hexafluorides of uranium at the pilot plant scale. Special studies have been devoted to the decontamination of the rare earth elements, thorium and zirconium. The refining of thorium in a solvent extraction composite column and the experimental production of crystallized nuclear grade thorium nitrate at the pilot plant scale is also discussed. Thorium hydroxide sludges and crystallized thorium sulphate are used as raw materials, both produced from an alkaline breaking up monazite process. Developmental efforts have also been directed towards the rare earth fractionation using as a first step previous chemical fractionation of the rare earth chlorides and the ion-exchange individual fractionation as the final process step to obtain extremely pure oxides. Finally, the establishment of analytical procedures as an important support to the technical work is emphasized. An extended version of this work will be published elsewhere.

0505 Uranium Enrichment

10744 **(CEA-CONF—9583) Computational fluid mechanics in R and D on uranium enrichment.** Soubbaramayer, O. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Inst. de Recherche Technologique et de Developpement Industriel (IRDI)). 1988. 16p. (CONF-8806297—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756227/JAW.

From Symposium in honor of Maurice Holt on his seventieth birthday; Hampton, VA, USA (26 Jun 1988).

Uranium enrichment represents an essential link in the cycle of nuclear fuels for power production. There are many processes of uranium enrichment, but three of them dominate the nuclear history as well in the past (Gaseous diffusion and centrifugation) as in the present (Laser process). The important role played by the Numerical Fluid Mechanics in the three processes is pointed out. The type of problem raised by Gaseous Diffusion is Channel Flow with wall suction, by Centrifugation, flow of a Compressible gas in a strongly rotating cylinder (Stewartson and Ekman layers) and by Laser process, Thermocapillary-buoyancy flow of a molten metal in an evaporation crucible. The methods and results in these problems are reviewed. 18 refs, 11 figs.

0507 Fuels Production And Properties

REFER ALSO TO CITATION(S) 11019, 11320, 11350, 11478, 12261, 12280, 12323

0508 Spent Fuels Reprocessing

REFER ALSO TO CITATION(S) 10832, 11315, 11481, 11529, 11538, 11665

10745 **(DOE/EIS—0136-Vol.1) Special Isotope Separation Project, Idaho National Engineering Laboratory, Idaho Falls, Idaho: Final Environmental Impact Statement.** (USDOE, Washington, DC). Nov 1988. Contract AC07-76ID01570. 558p. NTIS, PC A24/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005367/JAW.

The purpose of this Final Environmental Impact Statement (EIS) is to provide environmental input into a US Department of Energy (DOE) decision on the proposed construction and operation of a Special Isotope Separation (SIS) Project using the Atomic Vapor Laser Isotope Separation (AVLIS) process technology and on the selection of site for such a project. The SIS Project would provide DOE with the capability of segregating the isotopes of DOE-owned plutonium into specific isotopic concentrations. The alternatives considered in detail in this EIS include (1) constructing and operating the SIS Project at the Idaho National Engineering Laboratory (INEL) near Idaho Falls, Idaho (the Preferred Alternative); (2) constructing and operating the SIS Project at the Hanford Site near Richland, Washington; (3) constructing and operating the SIS Project at the Savannah River Plant (SRP) near Aiken, South Carolina; and (4) No Action, or not constructing and operating the SIS Project. This EIS includes discussion of the SIS facilities and processes; the environmental consequences of constructing and operating the facilities at the alternative sites for routine operations and accidental conditions; and the environmental consequences of No Action. 168 refs., 28 figs., 43 tabs.

10746 **(DOE/EIS—0136-Vol.2) Special Isotope Separation Project, Idaho National Engineering Laboratory, Idaho Falls, Idaho: Final Environmental Impact Statement.** (USDOE, Washington, DC). Nov 1988. Contract AC07-76ID01570. 679p. NTIS, PC A99/MF A01 - OSTI; 1; GPO Dep. Order Number TI89005368/JAW.

The purpose of this Final Environmental Impact Statement (EIS) is to provide environmental input into a US Department of Energy (DOE) decision on the proposed construction and operation of a Special Isotope Separation (SIS) Project using the Atomic Vapor Laser Isotope Separation (AVLIS) process technology and on the selection of a site for such a project. The SIS Project would provide DOE with the capability of segregating the isotopes of DOE-owned plutonium into specific isotopic concentrations. The alternatives considered in detail in the EIS include (1) constructing and operating the SIS Project at the Idaho National Engineering Laboratory (INEL) near Idaho Falls, Idaho (the preferred alternative); (2) constructing and operating the SIS Project at the Hanford Site near Richland, Washington; (3) constructing and operating the SIS Project at the Savannah River Plant (SRP) near Aiken, South Carolina; and (4) no action, or not constructing and operating the SIS Project. This EIS includes discussion of the SIS facilities and processes; the environmental consequences of constructing and operating the facilities at the alterative sites for routine operations and accidental conditions; and the environmental consequences of no action. This volume contains a summary of the public comments and a list of those who made public comments. The response by DOE is also included.

10747 **(DOE/EIS—0136-Vol.3) Special Isotope Separation Project, Idaho National Engineering Laboratory, Idaho Falls, Idaho: Final Environmental Impact Statement.** (USDOE, Washington, DC). Nov 1988. Contract AC07-76ID01570. 851p. NTIS, PC A99 - OSTI. Order Number DE89005369/JAW.

The purpose of this Final Environmental Impact Statement (EIS) is to provide environmental input into a US Department of Energy (DOE) decision on the proposed construction and operation of a Special Isotope Separation (SIS) Project using the Atomic Vapor Laser Isotope Separation (AVLIS) process technology and on the selection of a site for such a project. The SIS Project would provide DOE with the capability of segregating the isotopes of DOE-owned plutonium into specific isotopic concentrations. The alternatives considered in detail in this EIS include (1) constructing and operating the SIS Project at the Idaho National Engineering Laboratory (INEL) near Idaho Falls, Idaho: (2) constructing and operating the SIS Project at the Hanford Site near Richland, Washington; (3) constructing and operating the SIS Project at the Savannah River Plant (SRP) near Aiken, South Carolina; and (4) No Action, or not constructing and operating the SIS Project. This EIS includes discussion of the SIS facilities and processes; the environmental consequences of constructing and operating the facilities at the alternative sites; the environmental consequences of No Action; and the potential environmental consequences caused by postulated accidents. This volume contains the transcripts of 591 individuals who testified on this topic.

10748 **(DOE/EIS—0136-Vol.4) Special Isotope Separation Project, Idaho National Engineering Laboratory, Idaho Falls, Idaho: Final Environmental Impact Statement.** (USDOE, Washington, DC). Nov 1988. Contract AC07-76ID01570. 875p. NTIS, PC A99 - OSTI. Order Number DE89005370/JAW.

The purpose of this Final Environmental Impact Statement (EIS) is to provide environmental input into a US Department of Energy (DOE) decision on the proposed construction and operation of a Special Isotope Separation (SIS) Project using the Atomic Vapor Laser Isotope Separation (AVLIS) process technology and on the selection of a site for such a project. The SIS Project would provide DOE with the capability of segregating the isotopes of DOE-owned plutonium into specific isotopic concentrations. The alternatives considered in detail in this EIS include (1) constructing and operating the SIS Project at the Idaho National Engineering Laboratory (INEL) near Idaho Falls, Idaho; (2) constructing and operating the SIS Project at the Hanford Site near Richland, Washington; (3) constructing and operating the SIS Project at the Savannah River Plant (SRP) near Aiken, South Carolina; and (4) No action, or not constructing and operating the SIS Project. This EIS includes discussion of the SIS facilities and processes; the environmental consequences of constructing and operating the facilities at the alternative sites; the environmental consequences of No Action; and the potential environmental consequences caused by postulated accidents. This volume contains a description of 153 exhibits.

10749 **(DOE/EIS—0136-Vol.5) Special Isotope Separation Project, Idaho National Engineering Laboratory, Idaho Falls, Idaho: Final Environmental Impact Statement.** (USDOE, Washington, DC). Nov 1988. Contract AC07-76ID01570. 777p. NTIS, PC A99 - OSTI. Order Number DE89005371/JAW.

The purpose of this Final Environmental Impact Statement (EIS) is to provide environmental input into a US Department of Energy (DOE) decision on the proposed construction and operation of a Special Isotope Separation (SIS) Project using the Atomic Vapor Laser Isotope Separation (AVLIS) process technology and on the selection of a site for such a project. The SIS Project would provide DOE with the capability of segregating the isotopes of DOE-owned plutonium into specific isotopic concentra-

tions. The alternatives considered in detail in this EIS include (1) constructing and operating the SIS Project at the Idaho National Engineering Laboratory (INEL) near Idaho Falls, Idaho; (2) constructing and operating the SIS Project at the Hanford Site near Richland, Washington; (3) constructing and operating the SIS Project at the Savannah River Plant (SRP) near Aiken, South Carolina; and (4) No action, or not constructing and operating the SIS Project. This EIS includes discussion of the SIS facilities and processes; the environmental consequences of constructing and operating the facilities at the alternative sites; the environmental consequences of No Action; and the potential environmental consequences caused by postulated accidents. This volume contains a description of 651 exhibits.

10750 **(DOE/EIS—0136-Vol.6) Special Isotope Separation Project, Idaho National Engineering Laboratory, Idaho Falls, Idaho: Final Environmental Impact Statement.** (USDOE, Washington, DC). Nov 1988. Contract AC07-76ID01570. 702p. NTIS, PC A99 - OSTI. Order Number DE89005372/JAW.

The purpose of this Final Environmental Impact Statement (EIS) is to provide environmental input into a US Department of Energy DOE decision on the proposed construction and operation of a Special Isotope Separation (SIS) Project using the Atomic Vapor Laser Isotope Separation (AVLIS) process technology and on the selection of a site for such a project. The SIS Project would provide DOE with the capability of segregating the isotopes of DOE-owned plutonium into specific isotopic concentrations. The alternatives considered in detail in this EIS include (1) constructing and operating the SIS Project at the Idaho National Engineering Laboratory (INEL) near Idaho Falls, Idaho; (2) constructing and operating the SIS Project at the Hanford Site near Richland, Washington; (3) constructing and operating the (SIS) Project at the Savannah River Plant (SRP) near Aiken, South Carolina; and (4) No Action, or not constructing and operating the SIS Project. This EIS includes discussion of the SIS facilities and processes; the environmental consequences of constructing and operating the facilities at the alternative sites; the environmental consequences of No Action; and the potential environmental consequences caused by postulated accidents. This volume contains the comments of 631 individuals who submitted their comments in written form.

10751 **(INIS-mf—11881) Passivity and corrosion of special metals. Final report.** Schultze, J.W.; Elfenthal, L.; Meyer, A.; Hochfeld, A. (Duesseldorf Univ. (Germany, F.R.). Inst. fuer Physikalische Chemie und Elektrochemie; Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Apr 1988. 120p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88756500/JAW.

The corrosion stability of the metals Zr and Ta and some Ti-alloys was investigated under the conditions of the Purex-process. In addition to classical methods new corrosion-tests and simulations of technical conditions were developed. Further a laser-microprobe analysis is described. While Ta is stable at all conditions Zr shows decreasing corrosion stability with increasing nitric acid-concentration and temperature during potentiodynamic tests. Electrode modifications which are important for the Purex-process were checked. It is the first time that the stability of passive films against radiation is treated fundamentally. α-radiation and hot atoms can be simulated by ion-implantation. In general an amorphisation takes place which makes the layer more flexible and therefore more stable against mechanical stresses. Further the enhancement of electronic conductivity stabilises the favourable potential region between 0-1 V. Electronic processes can be simulated by focussed laser-radiation which induces the growth of additional oxide. The dissolution of oxide films of Ta and Ti is investigated by analysis and electrochemical measurements and is discussed with reference to decontamination processes. (orig.) With 61 refs., 15 tabs., 87 figs., and abstracts of 17 publications in annex.

10752 **(KFK—4437) Explosion and detonation of ozone in mixtures with carrier gases employed in nuclear technology.** Weh, M.M.L. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany. F.R.). Inst. fuer Radiochemie; Karlsruhe Univ. (T.H.) (Germany, F.R.). Fakultaet fuer Chemie). Sep 1988. 202p. (In German). NTIS (US Sales Only), PC A10/MF A01. Order Number DE88756389/JAW.

Explosive ozone is known to be formed during low temperature radiolysis of oxygen. Detailed knowledge on the explosion and the detonation of ozone is therefore required for safety considerations of nuclear installations such as proposed for the cryogenic separation of /sup 85/krypton from the head end off gas of a reprocessing plant. The explosion properties of gaseous ozone in mixtures with oxygen, nitrogen, helium, argon, krypton, xenon and difluorodichloromethane were studied by varying the ozone concentration, the initial pressure and the shape of the vessel containing the gas. Detonation velocities were determined for gaseous mixtures of ozone with oxygen, argon, krypton or xenon as functions of the ozone concentration. In addition, the initial pressure was varied for ozone-xenon mixtures. The effect of a packing such as used in the /sup 85/Kr-separation plant 'KRETA' in KfK on ozone-xenon detonation was investigated. In addition, the effect of low amounts of carbon monoxide, methane and nitrogen dioxide on the explosion (O/sub 3//Ar) and the detonation (O/sub 3//Xe) of an ozone-noble gas mixture was determined.

10753 **(DP-tr—113) Spheroidal uranium peroxide and manufacturing method thereof.** Dugua, J. (Savannah River Lab., Aiken, SC (USA)). [1988]. Contract AC09-76SR00001. Translation of Japanese Patent No. Sho 57[1982]-209807. 11p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004472/JAW.

The present invention relates to improved uranium peroxide and a method of preparing spheroidal uranium peroxide particles from a uranium-containing solution. Particularly, the present invention relates to practically spheroidal uranium peroxide particles having a high apparent bulk density, extremely excellent fluidity, and fixed particle-size distribution, as well as a method for preparing said spheroidal uranium peroxide particles from a uranium-containing solution by crystallization and flocculation. 3 figs.

0509 Transport And Storage

REFER ALSO TO CITATION(S) 11552

10754 **(NUREG/CR—4775) Guide for preparing operating procedures for shipping packages.** Witte, M.C. (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Engineering; Lawrence Livermore National Lab., CA (USA)). Dec 1988. Contract W-7405-ENG-48. 23p. (UCID—20820). NTIS, PC A03/MF A01 - GPO - OSTI. Order Number TI89005524/JAW.

This report provides guidance for writing manuals of operating procedures for shipping packages used for radioactive materials. Guidelines are provided which are based on the broad experience that exists in the shipping industry and are consistent with Subpart G to 10 CFR 71. 9 refs.

0520 Waste Management

REFER ALSO TO CITATION(S) 10745, 10745, 10746, 10746, 10747, 10747, 10748, 10748, 10749, 10749, 10750, 10750, 10828, 10829, 10830, 11469, 11552, 11811, 11812

10755 (AECL—8361, pp 2-25) **Thermodynamic data analysis using linear inequalities.** Brown, T.H.; Greenwood, H.J. (British Columbia Univ., Vancouver (Canada). Dept. of Geological Sciences). Jul 1984. NTIS (US Sales Only), PC A06/MF A01. Order Number DE84901833/JAW. (CONF-8309306—).

From Geochemistry of high-level waste disposal in granitic rocks workshop; Oxford, UK (12 Sep 1983).

Petrologists are increasingly turning to the results of phase equilibrium studies to estimate thermochemical data and mixing

properties of solids, gases and solutions. Most estimates are obtained by linear regression of phase equilibria data, a method which assumes that the equilibrium conditions (T,P,X) are known. The use of linear programming allows for a more rigorous mathematical treatment of phase equilibria data. In constrast to linear regression, which provides a unique fit that tends towards the midpoints of experimental brackets while not ensuring consistency with all brackets, linear programming ensures consistency with all experimental data, but provides a range of solutions, which can be unique only for a given objective function. Any new experimental data should be added to the existing thermodyamics data base and all of the data should be retested for internal consistency. This process of updating and the calculation of new phase relationships can be completed in a relatively short time because of the power and efficiency of the linear programming method. 10 refs.

10756 **(BMI/ONWI/C—239) Multispectral image analysis of the Palo Duro Basin, Texas: Final report.** Andre, C.G. (Battelle Memorial Inst., Columbus, OH (USA). Office of Nuclear Waste Isolation; Geosensing, Derwood, MD (USA)). Sep 1986. Contract AC02-87CH10290. 153p. OSTI, PO Bx 62, Oak Ridge, TN 37831- OSTI. Order Number TI88016457/JAW.

The objectives of this remote sensing study of the Palo Duro Basin are to: (1) detect the surface expression of regional subsurface structure; (2) locate previously unrecognized fractures; (3) interpret the data in terms of the geologic history of the Palo Duro Basin. Linear and circular surface features were mapped from Landsat 4 Thematic Mapper and NOAA-7 Advanced Very High Resolution Radiometer digital images of visible, near-infrared and thermal infrared bands. The density and orientation of features mapped are shown to be related to geological features, such as faults, structural arches, paleoerosion topography and salt dissolution zones. The approximate area covered by the three 185 km {times} 170 km Thematic Mapper images studied extends southward from the Canadian River Breaks to the Sand Hills and eastward from the western Mountains in Oklahoma. The day and night thermal infrared images from the NOAA-7 satellite encompass an area that includes the northern half of Texas and most of the surrounding states to the east, west and north. 4 refs.

10757 **(BNL—42120) Optimizing conditions for an accelerated leach test.** Pietrzak, R.F.; Fuhrmann, M.; Heiser, J.; Franz, E.M.; Colombo, P. (Brookhaven National Lab., Upton, NY (USA)). 1988. Contract AC02-76CH00016. 12p. (CONF-880839—12). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004889/JAW.

From Annual DOE low-level waste management conference; Denver, CO, USA (30 Aug 1988).

An accelerated leach test for low-level radioactive waste forms is being developed to provide, in a short time, data that can be extrapolated to long time periods. The approach is to provide experimental conditions that will accelerate leaching without changing the dominant release mechanism. Experimental efforts have focused on combining individual factors that have been observed to accelerate leaching. These include elevated temperature, increased leachant volume, and reduced specimen size. The response of diffusion coefficients to various acceleration factors have been evaluated and provide information on experimental parameters that need to be optimized to increase leach rates. For example, these data show that large volumes of leachant are required when leaching portland cement waste forms at elevated temperatures because of high concentrations of dissolved species. Sr-85 leaching is particularly susceptible to suppression due to concentration effects while Cs-137 leaching is less so. Preliminary modeling using a diffusion mechanism (allowing for depletion) of a finite cylinder geometry indicates that during early portions of experiments (daily sampling intervals), leaching is diffusion controlled and more rapid than later in the same experiments (weekly or greater sampling intervals). For cement waste forms, this reduction in rate may be partially controlled by changes in physical structure and chemistry (sometimes related to environmental influences such as CO_2), but it is more likely associated with the duration of the sampling interval. 9 refs., 6 figs.

10758 **(CEA-CONF—9404) Contribution of tracers to safety studies of radioactive and industrial waste disposal.** Beaudoing, G. (CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France)). Jun 1988. 8p. (In French). (CONF-880652—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88756214/JAW.

From International symposium on hydrogeology and safety of radioactive and industrial hazardous waste disposal; Orleans, France (7 Jun 1988).

This paper describes the possibility of tracers in hydrology for increase the safety of radioactive and industrial waste disposal. These possibilities concern the studies of sites, and the characteristics of waste disposal.

10759 **(CEA-CONF—9537) Catalyst study for the decontamination of glove-boxe atmospheres containing tritium at MPC levels.** Sannier, J. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Inst. de Recherche Technologique et de Developpement Industriel (IRDI)). 1988. 6p. (CONF-880505—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88756221/JAW.

From 3. topical meeting on tritium technology in fission, fusion and isotopic applications; Toronto, Canada (1 May 1988).

The BEATRICE loop was designed for studying the conversion of tritium at very low activity levels using catalytic oxidation followed by water trapping. The purpose is to study kinetic parameters required for the design of the NET tritium clean-up system with the two main objectives to operate without isotopic swamping and to determine the ability of efficient conversion at room temperature. From experiments carried out between 20 and 250/sup 0/C it is concluded that two palladium/alumina and platinum/alumina catalysts are very efficient in removing tritium from contaminated gas mixtures down to a few MPC levels without isotopic swamping and even at room temperature. However at room temperature, in relation to tritium species trapped on the catalyst surface a progressive deactivation with time occurs. This phenomenon may be a concern for process efficiency and tritium inventory and best regeneration conditions have to be determined in order to demonstrate industrial feasibility of operating at room temperature.

10760 **(CEA-CONF—9645) High-level waste vitrification: the state of the art in France.** Sombret, C.; Maillet, J. (CEA Etablissement de la Vallee du Rhone, 30 - Bagnols-sur-Ceze (France); Societe Generale pour les Techniques Nouvelles S.G.N., 78 - Saint-Quentin-en-Yvelines). (CEA Etablissement de la Vallee du Rhone, 30 - Bagnols-sur-Ceze (France)). Feb 1988. 8p. (CONF-880201—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88756231/JAW.

From Waste management '88: symposium on radioactive waste management; Tucson, AZ, United States (28 Feb 1988).

This paper describes the main features of the French high-level waste vitrification program. These features include: - extensive R and D for more than 20 years; - successful operation of the AVM facility at Marcoule for about 10 years; - startup of six vitrification lines at La Hague, in the near future. The CEA is pursuing R and D for mid-term vitrification enhancement. New R and D facilities are being built at Marcoule to increase the capacity of vitrification equipment, study glass preparation at even higher temperatures to increase SiO/sub 2/ and Al/sub 2/O/sub 3/ concentration, and perform extensive testing of samples with very high activity (more than 5,000Ci/l). 8 refs.

10761 **(CONF-881054—40) Field demonstration of in situ vitrification for application to ORNL liquid waste disposal trenches.** Spalding, B.P.; Jacobs, G.K. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 9p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005132/JAW.

From 4. annual DOE model conference; Oak Ridge, TN, USA (3 Oct 1988).

A field-scale vitrification of a 'cold' (nonradioactive) model of an old seepage trench was completed on July 20, 1987, by personnel of Battelle Pacific Northwest Laboratories in cooperation with ORNL. An estimated 20 tons of soil and crushed limestone backfill were melted. The desired melting depth of 2 m was

achieved. The molten mass tended to grow parallel to the long axis of the trench rather than symmetrically around the square array of electrodes. All melt geometry, safety, and process performance objectives were achieved satisfactorily. A 2-month cooling period was required before core sampling of the vitrified product was initiated. Samples of the off-gas scrub solutions have indicated that 99.88% and >99.99% of the cesium and strontium tracers, respectively, were retained in the trench. Samples of the field-produced material were found to be as good or better than two standard high-level nuclear vitreous waste forms using standard leach tests. Approximately half of the block devitrified or crystallized to pseudowollastonite and anorthite mineral phases during cooling. However, devitrification produced no significant change in the leach properties of the material.

10762 **(DOE/CH/10139—3(82-86)) Crystalline Repository Project: Technical progress report for the period October 1, 1982--May 28, 1986.** (Battelle Memorial Inst., Argonne, IL (USA). Office of Crystalline Repository Development). Nov 1988. Contract AC02-83CH10139. 93p. NTIS, PC A05/MF A01 - OSTI. Order Number DE89004704/JAW.

This document reports the progress made on the development of a second geologic repository in crystalline rocks during the duration of the Crystalline Repository Project from its inception in October 1982 to its termination in May 1986. The reporting elements are arranged by the work breakdown structure so that related studies are presented together. The studies are reported by the Office of Waste Technology Development (OWTD), successor to the Office of Crystalline Repository Development. OWTD is a prime contractor of the US Department of Energy (DOE) Repository Technology Program Office, itself the successor to the Crystalline Repository Project Office. The studies include work by other DOE prime contractors and by contractors to the Office of Crystalline Repository Development. 151 refs.

10763 **(DOE/CH/10139—T35) DOE hearing on the draft area recommendation report for the Crystalline Repository Project, Concord City Auditorium, Concord, New Hampshire: Volume 2, April 4, 1986: Transcript of proceedings.** (Battelle Memorial Inst., Columbus, OH (USA)). 1987. Contract AC02-83CH10139. 215p. NTIS, PC A10/MF A01 - OSTI. Order Number DE89002641/JAW.

This document contains a transcript of the comments of 42 witnesses. These meetings were held to hear public comments regarding the selection of a site for a second high-level nuclear waste repository. (TEM)

10764 **(DOE/CH/10139—T46) DOE hearing on the draft area recommendation report for the Crystalline Repository Project, Lake Region High School, Bridgton, Maine: Volume 1, April 5, 1986: Transcript of proceedings.** (Battelle Memorial Inst., Columbus, OH (USA)). 1986. Contract AC02-83CH10139. 171p. NTIS, PC A08/MF A01 - OSTI. Order Number DE89002627/JAW.

This document contains a transcript of the comments of 26 witnesses. These meetings were held to hear public comments regarding the selection of a site for a second high-level nuclear waste repository. (TEM)

10765 **(DOE/CH/10139—T47) DOE public hearing held at the New England College, Henniker, New Hampshire: Session 2, Volume 2, April 1, 1986.** (Battelle Memorial Inst., Columbus, OH (USA)). 1987. Contract AC02-83CH10139. 127p. NTIS, PC A07 - OSTI. Order Number DE89002617/JAW.

This document contains a transcript of the comments of 26 witnesses. These meetings were held to hear public comments regarding the selection of site for a second high-level nuclear waste repository. (TEM)

10766 **(DOE/CH/10139—T49) DOE hearing on the draft area recommendation report for the Crystalline Repository Project, Concord City Auditorium, Concord, New Hampshire: Volume 4, April 3, 1986: Transcript of proceedings.** (Battelle Memorial Inst., Columbus, OH (USA)). 1986. Contract AC02-83CH10139. 170p. NTIS, PC A08 - OSTI. Order Number DE89002583/JAW.

This document contains a transcript of the comments of 36 witnesses. These meetings were held to hear public comments regarding the selection of a site for a second high-level nuclear waste repository. (TEM)

10767 **(DOE/CH/10139—T50) DOE hearing on the draft area recommendation report for the Crystalline Repository Project, Augusta Armory, Augusta, Maine: Volume 3, April 7, 1986: Transcript of proceedings.** (Battelle Memorial Inst., Columbus, OH (USA)). 7 Apr 1986. Contract AC02-83CH10139. 112p. NTIS, PC A06 - OSTI. Order Number DE89002586/JAW.

This document contains a transcript of the comments of 17 witnesses. These meeting were held to hear public comments regarding the selection of a site for a second high-level nuclear waste repository. (TEM)

10768 **(DOE/CH/10139—T58) DOE hearing on the draft area recommendation report for the Crystalline Repository Project, The Pavilion Auditorium, Montpelier, Vermont: Volume 1, April 10, 1986: Transcript of proceedings.** (Battelle Memorial Inst., Columbus, OH (USA)). 1986. Contract AC02-83CH10139. 71p. NTIS, PC A04/MF A01 - OSTI. Order Number DE89002604/JAW.

This document contains a transcript of the comments of 8 witnesses. These meetings were held to hear public comments regarding the selection of a site for a second high-level nuclear waste repository. (TEM)

10769 **(DOE/CH/10139—T59) DOE hearing on the draft area recommendation report for the Crystalline Repository Project, Kennett High School, Conway, New Hampshire: Volume 4, April 14, 1986: Transcript of proceedings.** (Battelle Memorial Inst., Columbus, OH (USA)). 1986. Contract AC02-83CH10139. 71p. NTIS, PC A04/MF A01 - OSTI. Order Number DE89002601/JAW.

This document contains a transcript of the comments of 15 witnesses. These meetings were held to hear public comments regarding the selection of a site for a second high-level nuclear waste repository. (TEM)

10770 **(DOE/CH/10139—T60) DOE hearing on the draft area recommendation report for the Crystalline Repository Project, South Boston, Virginia: Session 1, March 26, 1986: Transcript of proceedings.** (Battelle Memorial Inst., Columbus, OH (USA)). 15 Apr 1986. Contract AC02-83CH10139. 232p. NTIS, PC A11/MF A01 - OSTI. Order Number DE89002600/JAW.

This document contains a transcript of the comments of 53 witnesses. These meetings were held to hear public comments regarding the selection of a site for a second high-level nuclear waste repository. (TEM)

10771 **(DOE/CH/10139—T68) DOE hearing on the draft area recommendation report for the Crystalline Repository Project, Lake Region High School, Bridgton, Maine, April 5, 1986: Volume 7: Transcript of proceedings.** (Battelle Memorial Inst., Columbus, OH (USA)). 1986. Contract AC02-83CH10139. 60p. NTIS, PC A04/MF A01 - OSTI; 1; GPO Dep. Order Number DE89002633/JAW.

This document contains a transcript of the comments of 10 witnesses. These meetings were held to hear the public's comments regarding the selection of a site for a second high-level radioactive waste repository. (TEM)

10772 **(DOE/CH/10139—T69) DOE hearing on the draft area recommendation report for the Crystalline Repository Project, Lake Region High School, Bridgton, Maine, April 5, 1986: Volume 5: Transcript of proceedings.** (Battelle Memorial Inst., Columbus, OH (USA)). 1986. Contract AC02-83CH10139. 99p. NTIS, PC A05/MF A01 - OSTI; 1; GPO Dep. Order Number DE89002631/JAW.

This document contains a transcript of the comments of 15 witnesses. These meetings were held to hear the public's comments regarding the selection of a site for a second high-level radioactive waste repository. (TEM)

10773 **(DOE/CH/10139—T79) DOE hearing on the draft area recommendation report for the Crystalline Repository Project, Concord City Auditorium, Concord, New Hampshire, April 3, 1986: Volume 2: Transcript of proceedings.** (Battelle Memorial Inst., Columbus, OH (USA)). 1986. Contract AC02-83CH10139. 174p. NTIS, PC A08 - OSTI. Order Number DE89002574/JAW.

This document contains a transcript of the comments of 36 witnesses. These meetings were held to hear the public's comments regarding the selection of a site for a second high-level radioactive waste repository. (TEM)

10774 **(DOE/CH/10139—T80) DOE hearing on the draft area recommendation report for the Crystalline Repository Project, Mary Persons High School, Forsyth, Georgia, April 2, 1986: Transcript of proceedings.** (Battelle Memorial Inst., Columbus, OH (USA)). 1986. Contract AC02-83CH10139. 188p. NTIS, PC A09/MF A01 - OSTI. Order Number DE89002599/JAW.

This document contains a transcript of the comments of more than 28 witnesses. These meetings were held to hear public comments regarding the selection of a site for a second high-level nuclear waste repository. (TEM)

10775 **(DOE/CH/10139—T83) DOE hearing on the draft area recommendation report for the Crystalline Repository Project, Ada High School Gymnasium, Ada, Minnesota, April 3, 1986: Transcript of proceedings.** (Battelle Memorial Inst., Columbus, OH (USA)). 1986. Contract AC02-83CH10139. 303p. NTIS, PC A14/MF A01 - OSTI; 1; GPO Dep. Order Number DE89002597/JAW.

This document contains a transcript of the comments of 64 witnesses. These meetings were held to hear the public's comments regarding the selection of a site for a second high-level radioactive waste repository. (TEM)

10776 **(DOE/CH/10139—T86) DOE hearing on the draft area recommendation report for the Crystalline Repository Project, Calais High School, Calais, Maine, April 8, 1986: Volume 2: Transcript of proceedings.** (Battelle Memorial Inst., Columbus, OH (USA)). 1986. Contract AC02-83CH10139. 185p. NTIS, PC A09 - OSTI. Order Number DE89002588/JAW.

This document contains a transcript of the comments of 32 witnesses. These meetings were held to hear the public's comments regarding the selection of a site for a second high-level radioactive waste repository. (TEM)

10777 **(DOE/CH/10139—T87) DOE hearing on the draft area recommendation report for the Crystalline Repository Project, Kennett High School, Conway, New Hampshire: Volume 3, April 14, 1986: Transcript of proceedings.** (Battelle Memorial Inst., Columbus, OH (USA)). 1986. Contract AC02-83CH10139. 112p. NTIS, PC A06 - OSTI. Order Number DE89002522/JAW.

This document contains a transcript of the comments of 26 witnesses. These meetings were held to hear public comments regarding the selection of a site for a second high-level nuclear waste repository. (TEM)

10778 **(DOE/CH/10139—T93) DOE hearing on the draft area recommendation report for the Crystalline Repository Project, Augusta Armory, Augusta, Maine, April 7, 1986: Volume 4: Transcript of proceedings.** (Battelle Memorial Inst., Columbus, OH (USA)). 1986. Contract AC02-83CH10139. 81p. NTIS, PC A05 - OSTI. Order Number DE89002530/JAW.

This document contains a transcript of the comments of 6 witnesses. These meetings were held to hear the public's comments regarding the selection of a site for a second high-level radioactive waste repository. (TEM)

10779 **(DOE/CH/10139—T94) DOE hearing on the draft area recommendation report for the Crystalline Repository Project, Augusta Armory, Augusta, Maine, April 7, 1986: Volume 5: Transcript of proceedings.** (Battelle Memorial Inst., Columbus, OH (USA)). 1986. Contract AC02-83CH10139. 79p. NTIS, PC A05/MF A01 - OSTI; 1; GPO Dep. Order Number DE89002529/JAW.

This document contains a transcript of the comments of 11 witnesses. These meetings were held to hear the public's comments regarding the selection of a site for a second high-level radioactive waste repository. (TEM)

10780 **(DOE/CH/10139—T95) DOE hearing on the draft area recommendation report for the Crystalline Repository Project, Concord City Auditorium, Concord, New Hampshire, April 3, 1986: Volume 3: Transcript of proceedings.** (Battelle Memorial Inst., Columbus, OH (USA)). 1986. Contract AC02-83CH10139. 180p. NTIS, PC A09 - OSTI. Order Number DE89002584/JAW.

This document contains a transcript of the comments of 32 witnesses. These meetings were held to hear the public's comments regarding the selection of a site for a second high-level radioactive waste repository. (TEM)

10781 **(DOE/HWP—73) Packaging guide for transportation of low-level radioactive mixed waste: Hazardous Waste Remedial Actions Program.** (Idaho National Engineering Lab., Idaho Falls (USA); Ebasco Services, Inc., Bellevue, WA (USA)). Nov 1988. Contract AC05-84OR21400. 328p. NTIS, PC A15 - OSTI. Order Number DE89004245/JAW.

This report is designed to assist the Department of Energy (DOE) in characterizing low-level radioactive mixed waste and identifying the proper packaging required for highway transportation. It consists of a detailed review of Department of Transportation (DOT), Environmental Protection Agency (EPA), and DOE requirements in the form of flow charts to reflect these regulations. DOE orders require conformance to DOT requirements for off-site shipments. The appendices cover forbidden chemicals (Appendix 1), activity limits (Appendix 2), special form and normal form values for radionuclides (Appendix 3), contamination control (Appendix 4), hazardous materials not accepted as small quantity (Appendix 5), packaging available for different types of waste (Appendix 6), packaging vendor information (Appendix 7), DOT table of hazardous materials (Appendix 8), and the DOE evaluation document for DOT 7A type A packaging (Appendix 9). This report addresses the packaging of low-level radioactive mixed waste for interstate highway transportation. It does not include packaging requirements for air freight or rail transportation or for export out of the continental United States.

10782 **(DOE/LLW—40T) Development of threshold guidance: National Low-Level Radioactive Waste Management Program.** (EG and G Idaho, Inc., Idaho Falls (USA)). Sep 1986. Contract AC07-76ID01570. 339p. (MISC—88148). NTIS, PC A15/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004873/JAW.

The current study has been conducted to provide DOE with a technical basis for the development of threshold guidance. The objective of the study was to develop the necessary background information and recommendations to assist the DOE in implementing the threshold limit concept for the disposal of DOE wastes at DOE facilities. The nature of low-level radioactive waste (LLW) varies greatly in both form and radionuclide content. While some low-

level waste streams can contain substantial quantities of radioactive constituents, a potentially significant fraction of low-level waste is contaminated either very slightly or not at all. There is a strong likelihood that managing wastes with extremely low levels of radioactivity as nonradioactive waste would pose no significant safety problems and could result in substantial cost savings relative to its handling as LLW. Since all materials, including waste products, contain some radioactivity, it is necessary to distinguish between those wastes that would require disposal as LLW and those that have sufficiently low levels of radiological content to be managed according to their nonradiological properties. 131 refs., 9 figs., 24 tabs.

10783 **(DOE/RW/00038—T1) A study of extra large storage casks.** McCreery, P.N. (Transnuclear, Inc., White Plains, NY (USA)). 31 Dec 1986. Contract AC01-84RW00038. 234p. NTIS, PC A11/MF A01 - OSTI. Order Number DE89004991/JAW.

The scope of this study includes a technical evaluation of and conceptual designs for storage/transport and storage-only XLSC's, each containing either intact assemblies or consolidated fuel rods. For the consolidated fuel case, a conceptual design is presented for a transportable fuel disassembly and rod consolidation hot cell called the Mobile Equipment for Consolidation (MEC). The MEC is located and operated within a utility-provided structure called the Stationary Equipment for Consolidation (SEC). The study evaluates the XLSC and MEC concepts, together with ancillary systems and equipment concepts, for technical feasibility and for their impact on the rest of the waste management system in terms of modifications at handling sites, acceptance, costs, safety and licensing/regulatory considerations.

10784 **(DOE/WIPP—88-024) Tests of model Waste Isolation Pilot Plant Site exhaust airflow systems.** Turner, W.D.; McFarland, A.R.; Glass, M.G.; Ortiz, C.A.; O'Neal, D.L.; Somasundaram, S.; Anand, N.K.; DeOtte, R.E. Jr. (Westinghouse Electric Corp., Carlsbad, NM (USA). Waste Isolation Div.; Texas A and M Univ., College Station (USA). Energy Systems Lab.). Sep 1988. Contract AC04-86AL31950. 297p. NTIS, PC A13/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005026/JAW.

Scale-models of the proposed above-ground, exhaust ventilation system at the Waste Isolation Pilot Plant (WIPP) site were developed and evaluated. The basic scale ratios were 1:5 for physical size and 1:25 for flow rate. Thus, the basic laboratory model testing had the same nominal velocities as the prototype, but had Reynolds numbers 1/5 that of the prototype. However, some special tests were conducted with models that provided a relatively close matching of the prototype Reynolds numbers. The purposes of the testing were to recommend locations for the aerosol samplers and to determine the expected velocity and concentration profiles at those locations. Flow straighteners were also to be investigated to determine their effectiveness for this application. 7 refs., 157 figs.

10785 **(DPST—86-445) Fate of organics introduced into the DWPF melter feed preparation facilities.** Jacobs, R.A.; Landon, L.F. (Savannah River Lab., Aiken, SC (USA)). 11 Jun 1986. Contract AC09-76SR00001. 7p. NTIS, PC A02 - OSTI. Order Number DE89003446/JAW.

About 26 tons per year of aromatic hydrocarbons will accompany the aqueous product stream from Acid Hydrolysis and be blended with washed sludge in the melter feed preparation facilities. In April, 1985, R.E. Eibling provided an estimate of organics in the aqueous recycle stream to the H area tank farm of 3.7 tons per year. This estimate was based on short duration laboratory scale simulations of SRAT/SME batches. These laboratory runs did not simulate critical items such as air in-leakage proposed operating temperature of the SRAT and SME condensers and full cycle times. A more realistic model of the melter feed preparation cycle was requested to provide the basis for an update of the previous estimate. The Simulation Sciences' PROCESS program was utilized to model the SRAT/SME batch cycle. About 17 tons of organics will be recycled from the DWPF to the H area waste farm. Ninety-one percent of this organic recycle originates from the aromatics stripped and subsequently condensed during SRAT/SME operations. The remainder represents a fraction of the free aromatics entering the melter that are not combusted and enter the melter off-gas system (subsequently condensed as phenol). Benzene (in solution) will accompany the aqueous product from Acid Hydrolysis (concentration---about 0.05 wt %). Additional benzene will be produced during SRAT/SME operations from decomposition of the phenylboric acid. Ninety-four percent of the total benzene inventory will be released to the atmosphere via the feed preparation vessel vent system. The remainder will be recycled to the tank farm, most likely entering the atmosphere during waste evaporation. 4 tabs.

10786 **(EGG-ESQ—8285) Offsite shipping data base design and implementation.** Watanabe, T. (EG and G Idaho, Inc., Idaho Falls (USA)). Oct 1988. Contract AC07-76ID01570. 39p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89004950/JAW.

An offsite shipping data base was developed to monitor the shipment of low-level radioactive solid waste (LLW) to offsite disposal sites by DOE contractors. The data base is embedded in the Solid Waste Information System (SWIMS) system which contains data on LLW generated by DOE contractors. Embedding this data base in SWIMS allows not only access to data common to both systems but also the direct inheritance of all system features contained in SWIMS. 2 refs., 9 tabs.

10787 **(EGG-M—28687) Low-level radioactive waste site selection and site characterization handbooks.** Tullis J.A.; Reyes, B.D. (EG and G Idaho, Inc., Idaho Falls (USA)). 1988. Contract AC07-76ID01570. 3p. (CONF-880201—44). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005197/JAW.

From Waste management '88: symposium on radioactive waste management; Tucson, AZ, United States (28 Feb 1988).

Two resource documents have been developed to provide technical assistance to states and compact regions in selecting and characterizing sites for disposal of low-level radioactive wastes (LLW). The Site Selection Handbook provides basic information on the components of a comprehensive site selection program. It also serves as the basis for a two-day workshop on site selection. The Site Characterization Handbook is a reference document for developing and managing a comprehensive site characterization program which will support a license application for a LLW disposal facility.

10788 **(EGG-M—29787) Spent fuel treatment to allow storage in air.** Williams, K.L. (EG and G Idaho, Inc., Idaho Falls (USA)). 1988. Contract AC07-76ID01570. 9p. (CONF-880201—42). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number TI89005169/JAW.

From Waste management '88: symposium on radioactive waste management; Tucson, AZ, United States (28 Feb 1988).

During Fiscal Year 1987 (FY-87), research began at the Idaho National Engineering Laboratory (INEL) to develop a treatment material and process to coat spent fuel rods in commercial spent fuel assemblies to allow the assemblies to be stored in hot (up to 380{degree}C) air without oxidation of the fuel. This research was conducted under a research and development fund provided by the US Department of Energy (DOE) and independently administered by EG and G Idaho, Inc., DOE's prime contractor at the INEL. The objectives of the research were to identify and evaluate possible treatment processes and materials, identify areas of uncertainty, and to recommend the most likely candidate to allow spent fuel dry storage in hot air. The results of the research are described: results were promising and several good candidates were identified, but further research is needed to examine the candidates to the point where comparison is possible. 9 refs.

10789 **(EGG-M—30187) Greater-than-Class-C low-level radioactive waste management concepts.** Knecht, M.A. (EG and G Idaho, Inc., Idaho Falls (USA)). 1988. Contract AC07-76ID01570. 8p. (CONF-880201—43). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005196/JAW.

From Waste management '88: symposium on radioactive waste management; Tucson, AZ, United States (28 Feb 1988).

In 1986, Public Law 99-240, the "Low-Level Radioactive Waste Policy Amendments Act of 1985" assigned to the federal government responsibility for the disposal of commercial greater-than-Class-C (GTCC) low-level radioactive waste (LLW). In 1987, DOE committed to Congress to accept GTCC LLW and provide storage and other waste management as necessary until disposal capacity is available. Current estimates are that about 6000 m^3 of unpackaged GTCC LLW will be generated to the year 2020. Generators estimate that 110 m^3 of raw GTCC LLW might exceed planned storage capacity to the year 2020. This paper reports the activities of the National Low-Level Waste Program to manage GTCC low-level radioactive waste. 6 refs.

10790 **(EGG-M—88192) Community relations for the transport of TMI-2 core debris.** Smith, T.A. (EG and G Idaho, Inc., Idaho Falls (USA)). 1988. Contract AC07-76ID01570. 10p. (CONF-881024—8). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005283/JAW.

From TMI-2 accident materials behavior, plant technology and recovery; Washington, DC, United States (30 Oct 1988).

This paper describes community relations for the transport of Three Mile Island Unit 2 core debris, before and during the first two years of the campaign. The author defines community relations as interactions with groups or individuals to influence public perception. Members of Congress, state and local officials, news media, special interest groups, and private citizens are included in the definition of community. The paper discusses issues of concern to the community, level of interest generated by the transport campaign, events that kept community interest focused on the campaign, and communication techniques employed to provide the community with factual information and to generate public confidence. Finally, the paper describes lessons learned from the community relations effort. 10 refs., 3 figs.

10791 **(EGG-M—88377) Status of DOE information network modifications.** Fuchs, R. (EG and G Idaho, Inc., Idaho Falls (USA)). 1988. Contract AC07-76ID01570. 6p. (CONF-880839—13). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005191/JAW.

From Annual DOE low-level waste management conference; Denver, CO, USA (30 Aug 1988).

This paper provides an update for conference participants on changes, that have been made, or are taking place, to the Department of Energy's National Information Network. A question and answer period is anticipated. Areas of focus are data acquisition from commercial disposal site operators, improved access methods to DOE Information network, progress on personnel computer interfaces, and availability of end user support.

10792 **(EGG-M—88395) Management program for underground storage tanks at the Idaho National Engineering Laboratory.** Broomfield, B.J. (EG and G Idaho, Inc., Idaho Falls (USA)). 1988. Contract AC07-76ID01570. 9p. (CONF-881054—39). NTIS, PC A02/MF A01 - OSTI; GPO Dep. Order Number DE89005181/JAW.

From 4. annual DOE model conference; Oak Ridge, TN, USA (3 Oct 1988).

In anticipation of the national Underground Storage Tank (UST) regulations, the Idaho National Engineering Laboratory (INEL) developed a comprehensive management program for USTs. Principle requirements of the proposed regulations that will impact INEL operations are that existing storage tanks will need to be upgraded to new technical standards; new storage tanks will have to meet new technical standards; all storage tanks will require the implementation of more complex operations, record keeping and management plans; and responses to spills and leaks will involve compliance with regulations, including RCRA, CERCLA and SARA for reporting and corrective action. The purpose of the INEL UST management program is to ensure progress toward compliance while minimizing costs and impacts to on-site operations involving tanks. The program considers UST standards for new tank design, construction, installation, operation, maintenance, replacement and record keeping. It focuses on obtaining pertinent data and developing a method to assess the probability of tank failure, determine risks from tank releases, and prioritizing tanks for upgrading to new performance standards or replacement. 5 refs.

10793 **(EUR—11444) Sequestration in hydrothermally modified zeolite 5A of Kr-85 from reprocessing: mechanism of fixation and characterization of the product.** Dorea, A.; Penzhorn, R.D.; Ache, H.J. (Kernforschungszentrum Karlsruhe G.m.b.H (DE). Inst. fuer Radiochemie). (Commission of the European Communities, Luxembourg). 1988. 36p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756437/JAW.

A large number of Kr and Xe encapsulates having loadings between 7.1 and 58.2 (ml STP/g) were prepared from type A zeolites of different aggregation forms (pellet, powder), containing the earth alcaline cations Mg, Ca and Sr as well as the cation Na at various compositions. Under the conditions employed the achievable loading was found to be only a function of pressure, irrelevant of the type of trapped noble gas. As observed by X-ray and infrared spectroscopy the encapsulates do not recrystallize at high temperatures. Only after the trapped gas has been completely released will the amorphous matrix become crystalline. The gas release from the encapsulates can be described by a diffusion model. Experimentally it was shown that the rate-determining step describing the thermal gas evolution out of the pellets is the diffusion through vitrified particles with a size of a few μm and not the mass transport through the macropores. A high zeolite pellet bulk density in the autoclave can be achieved by mixing fractions of appropriate pellet size distribution. The encapsulates do not liberate the sequestered gas when exposed to water, irrespective of the conditions employed for the fixation of the noble gas.

10794 **(GSF-T—174) AWID - an absolutely measuring stress cell using the compensation technique.** Kessels, W.; Flentge, I.; Kolditz, H.; Muth, M. (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H. Muenchen, Neuherberg (Germany, F.R.)). Dec 1983. 48p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756494/JAW.

According to the measuring principle of the stress cell explained in this report, stresses can be measured without materials parameters of the cell influencing the measurements, so that calibration measurements are not required for this absolutely measuring cell. There is no temperature dependence either. The report discusses the functioning mode which is based on evaluation of a gap in the resistance of the cell which is induced when two sheets move apart from each other in the process of pumping hydraulic oil, at the point when external pressure is reached. Theoretical studies were supplemented by laboratory tests both in an autoclave and in a tube filled with salt rock grus, under a uniaxial press. The error observed with measurements in an oil-pressure autoclave was within the order of magnitude of the reading accuracy of the measuring equipment, i.e. it was less than 0.3% at 150 bar. This is to be taken as the error to be attributed to the cell.

10795 **(INIS-BR—1384) Inventory of Cesium 137 source.** Heilbron Filho, P.F.L.; Oliveira Brandao, R. de. (Comissao Nacional de Energia Nuclear, Rio de Janeiro, RJ). 1988. 1p. (In Portuguese). NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS. Order Number DE88705269/JAW.

10796 (INIS-mf—11332, pp 32) **Liquid waste processing from Triga spent fuel storage pits.** Buchtela, K. (Atominstitut der Oesterreichischen Universitaeten, Vienna). 1988. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705189/JAW. (CONF-8809213—).

From IAEA Meeting: 10th European TRIGA users' conference; Vienna, Austria (14 Sep 1988).

10797 **(IPEN-Pub—133) Treatment and conditioning of institutional waste in Brazil.** Suarez, A.A.; Rozental, J. de J. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo, SP (Brazil)). Jun 1988. 22p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704152/JAW.

An important condition for the expansion of electricity generation from nuclear reactors in the next future is the control of the nuclear fuel cycle. A quite important branch of this cycle is played by the management of radioactive waste. In Brazil there are one nuclear power plant in operation (626 MWe); mining and milling

industry, a fuel fabrication plant; three nuclear research institutes including a radioisotope production facility; some accelerators and about 2000 institutions (medicine, industry, agriculture, research centers etc) widespread throughout the country utilizing radionuclides on a large scale. In Brazil there is not a defined final repository to receive the radioactive waste produced in the country. Instead, all radioactive wastes produced must be treated insuch a way that: - The volume of the waste is minimized as much as possible - The release of radionuclides into the environment is as low as possible - The radioactive materials are immobilized for storage over long periods safely and preventing them to contact the biocycle. Discussions are made concerning the Brazilian policy and the waste treatment research program carried out by the Instituto de Pesquisas Energeticas e Nucleares (IPEN), scientific branch of the National Comission of Nuclear Energy (CNEN).

10798 **(KY-L—1506) Low-level fluoride trapping studies experimental work for computer modeling program.** Russell, R.G. (Paducah Gaseous Diffusion Plant, KY (USA)). 21 Nov 1988. Contract AC05-84OU21400. 28p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005029/JAW.

The material presented in this report involved experimental work performed to assist in determining the constants for a computer modeling program being developed by Production Engineering for use in trap design. Included in this study is bed distribution studies to define uranium loading on alumina (Al_2O_3) and sodium fluoride (NaF) with respect to bed zones. A limited amount of work was done on uranium penetration into NaF pellets. Only the experimental work is reported here; Production Engineering will use this data to develop constants for the computer model. Some of the significant conclusions are: NaF has more capacity to load UF_6, but Al_2O_3 distributes the load more equally; velocity, system pressure, and operating temperature influence uranium loading; and in comparative tests NaF had a loading of 25%, while Al_2O_3 was 13%. 2 refs., 10 figs., 5 tabs.

10799 **(LA—11398-MS) Nevada Nuclear Waste Storage Investigations: Exploratory Shaft Facility fluids and materials evaluation.** West, K.A. (Los Alamos National Lab., NM (USA)). Nov 1988. Contract W-7405-ENG-36. 155p. NTIS, PC A08/MF A01 - OSTI. Order Number DE89005292/JAW.

The objective of this study was to determine if any fluids or materials used in the Exploratory Shaft Facility (ESF) of Yucca Mountain will make the mountain unsuitable for future construction of a nuclear waste repository. Yucca Mountain, an area on and adjacent to the Nevada Test Site in southern Nevada, USA, is a candidate site for permanent disposal of high-level radioactive waste from commercial nuclear power and defense nuclear activities. To properly characterize Yucca Mountain, it will be necessary to construct an underground test facility, in which in situ site characterization tests can be conducted. The candidate repository horizon at Yucca Mountain, however, could potentially be compromised by fluids and materials used in the site characterization tests. To minimize this possibility, Los Alamos National Laboratory was directed to evaluate the kinds of fluids and materials that will be used and their potential impacts on the site. A secondary objective was to identify fluids and materials, if any, that should be prohibited from, or controlled in, the underground. 56 refs., 19 figs., 11 tabs.

10800 **(NUREG—1293) Quality assurance guidance for low-level radioactive waste disposal facility: Final report.** Pittiglio, C.L. Jr. (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Material Safety and Safeguards). Jan 1989. 29p. NTIS, PC A03/MF A01 - GPO - OSTI. Order Number TI89005522/JAW.

This document provides guidance to an applicant on meeting the quality control (QC) requirements for a low-level waste (LLW) disposal facility. The QC requirements are the basis for developing of a quality assurance (QA) program and for the guidance provided herein. The criteria are basic to any QA program. The document specifically establishes QA guidance for the design, construction, and operation of those structures, systems, components, as well as, for site characterization activities necessary to meet the performance objectives and to limit exposure to our release of radioactivity. 7 refs.

10801 **(NUREG/CR—5243) Borehole closure in salt.** Fuenkajorn, K.; Daemen, J.J.K. (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Engineering; Arizona Univ., Tucson (USA). Dept. of Mining and Geological Engineering). Dec 1988. 475p. NTIS, PC A20/MF A01 - GPO - OSTI. Order Number TI89005531/JAW.

Constitutive law parameters are determined from salt behavior characterization experiments. The results are applied to predict creep (time-dependent) closure of boreholes in salt specimens subjected to various loading configurations. Rheological models (linear and nonlinear viscoelastic and viscoplastic models), empirical models, and physical theory models have been formulated from the results of uniaxial creep tests, strain and stress rate controlled uniaxial tests, constant strain rate triaxial tests, cyclic loading tests, and seismic velocity measurements. Analytical solutions for a thick-walled cylinder subjected to internal and external pressures and for a circular hole in an infinite plate subjected to a biaxial or uniaxial stressfield have been derived from each of the linear viscoelastic models and from one of the empirical laws. The experimental results indicate that the salt samples behave as an elastic-viscoplastic material. The elastic behavior tends to be linear and time-independent. The plastic deformation is time-dependent. The stress increment to strain rate increment ratio gradually decreases as the stress level increases. The transient potential creep law seems to give the simplest satisfactory governing equation describing the viscoplastic behavior of salt during the transient phase. 204 refs., 27 figs., 29 tabs.

10802 **(ORNL/TM—10757) Overall strategy and program plan for management of radioactively contaminated liquid wastes and transuranic sludges at the Oak Ridge National Laboratory.** McNeese, L.E.; Berry, J.B.; Butterworth, G.E. III; Collins, E.D.; Monk, T.H.; Patton, B.D.; Snider, J.W. (Oak Ridge National Lab., TN (USA)). Dec 1988. Contract AC05-84OR21400. 126p. NTIS, PC A07/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005684/JAW.

The use of hydrofracture was terminated after 1984, and LW concentrate has been accumulated and stored since that time. Currently, the volume of stored LW concentrate is near the safe fill limit for the 11 storage tanks in the active LW system, and significant operational constraints are being experienced. The tanks that provide the storage capacity of the active LW system contain significant volumes of TRU sludges that have been designated remote-handled transuranic (RH-TRU) wastes because of associated quantities of other radioisotopes, including ^{90}Sr and ^{137}Cs. Thirty-three additional tanks, which are inactive, also contain significant volumes of TRU waste and radioactive LW. A lack of adequate storage volume for LW jeopardizes ORNL's ability to ensure continued conduct of research and development (R&D) activities that generate LW because an unexpected operational incident could quickly deplete the remaining storage volume. Accordingly, a planning team comprised of staff members from the ORNL Nuclear and Chemical Waste Programs (NCWP) was created for developing recommended actions to be taken for management of LW. A program plan is presented which outlines work required for the development of a disposal method for each of the likely future waste streams associated with LW management and the disposal of the bulk of the resulting solid waste on the ORR. 8 refs., 20 figs., 12 tabs.

10803 **(PB—89-114250/XAB) Evaluation of options for managing greater-than-Class-C low-level radioactive waste. Background paper.** (Office of Technology Assessment (U.S. Congress), Washington, DC). Oct 1988. 54p. (OTA-BP-O—50). NTIS, PC A04/MF A01.

See also PB—87-139622. Library of Congress catalog card no. 88-600589.

The most-significant finding of this study deals with the storage of GTCC (greater-than-Class C) low-level radioactive waste. Since disposal facilities for GTCC waste will not be available for at least fifteen to twenty years, GTCC waste will have to remain in storage. The period of extended storage could be extremely difficult for many GTCC material users and waste generators. OTA has developed a possible approach for addressing these problems.

10804 **(PB—89-120794/XAB) Study of deep ocean currents near the 3800-M low-level radioactive waste disposal site. May 1984-May 1986. Final report.** Casagrande, C.; Hamilton, P. (Office of Radiation Programs, Washington, DC (USA)). Jun 1988. 62p. (EPA—520/1-88/007). NTIS, PC A04/MF A01.

The report presents the results of a two-year study of a U.S. 3800-m low-level radioactive waste-disposal site near the mouth of the Hudson Canyon. The program objectives were to describe the currents, including their source and variability, and deduce from the data the potential for, and direction of, transport of contaminants from the disposal area. The results show that the currents in the disposal area range in strength from a few to 62 cm/sec and are principally due to the presence of low-frequency topographic Rossby waves having periods of approximately two to four weeks. The currents generally flow towards the southwest, in line with the general topography of the mid-Atlantic region. The canyon acts to distort the southwest flow, resulting in currents below the canyon rim which are aligned with the canyon onshore-offshore axis. The direction of currents along the canyon axis appears to be determined by the proximity of both the Gulf Stream and the Western Boundary Undercurrent.

10805 **(PNL—5714-1) WASTES-II: Waste System Transportation and Economic Simulation--Release 24: User's guide.** Ouderkirk, S.J. (Pacific Northwest Lab., Richland, WA (USA)). Dec 1988. Contract AC06-76RL01830. 132p. NTIS, PC A07/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005506/JAW.

WASTES models each reactor pool and an at-reactor, out-of-pool (ex-pool) storage facility for each reactor site. Spent fuel transfers between pools can be simulated under various constraints controlled by user input. In addition to simulating each pool and ex-pool facility, WASTES can accommodate up to ten other storage facilities of four different types: federal interim storage (FIS), monitored retrievable storage (MRS), auxiliary plants, and repositories. Considerable flexibility is allowed for the user to specify system configuration and priorities for fuel receipts. In addition, the WASTES computer code simulates very detailed (assembly-specific) movements of spent fuel throughout the waste management system. Spent fuel characteristics that are tracked by WASTES for each movement are: discharge year and month, number of assemblies, weight of uranium (MTU), exposure, original enrichment, and heat generation rate (calculated from the preceding characteristics). Data for the WASTES model is based upon the DOE reactor-specific spent fuel data base, which is developed and maintained by the Energy Information Administration (EIA). In addition to the spent fuel characteristics, this data includes reactor location, type, transportation access, and historical and projected discharge data on the number of fuel assemblies. 8 refs., 3 figs., 4 tabs.

10806 **(PNL—6456-Vol.1) Hazard Ranking System evaluation of CERCLA [Comprehensive Environmental Response, Compensation, and Liability Act] inactive waste sites at Hanford: Volume 1, Evaluation methods and results.** Stenner, R.D.; Cramer, K.H.; Higley, K.A.; Jette, S.J.; Lamar, D.A.; McLaughlin, T.J.; Sherwood, D.R.; Van Houten, N.C. (Pacific Northwest Lab., Richland, WA (USA)). Oct 1988. Contract AC06-76RL01830. 189p. NTIS, PC A09/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005482/JAW.

The purpose of this report is to formally document the individual site Hazard Ranking System (HRS) evaluations conducted as part of the preliminary assessment/site inspection (PA/SI) activities at the US Department of Energy (DOE) Hanford Site. These activities were carried out pursuant to the DOE orders that describe the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Program addressing the cleanup of inactive waste sites. These orders incorporate the US Environmental Protection Agency methodology, which is based on the Superfund Amendments and Reauthorization Act of 1986 (SARA). The methodology includes six parts: PA/SI, remedial investigation/feasibility study, record of decision, design and implementation of remedial action, operation and monitoring, and verification monitoring. Volume 1 of this report discusses the CERCLA inactive waste-site evaluation process, assumptions, and results of the HRS methodology employed. Volume 2 presents the data on the individual CERCLA engineered-facility sites at Hanford, as contained in the Hanford Inactive Site Surveillance (HISS) Data Base. Volume 3 presents the data on the individual CERCLA unplanned-release sites at Hanford, as contained in the HISS Data Base. 34 refs., 43 figs., 47 tabs.

10807 **(PNL—6456-Vol.2) Hazard ranking system evaluation of CERCLA inactive waste sites at Hanford: Volume 2: Engineered-facility sites (HISS data base).** Jette, S.J.; Lamar, D.A.; McLaughlin, T.J.; Sherwood, D.R.; Van Houten, N.C.; Stenner, R.D.; Cramer, K.H.; Higley, K.A. (Pacific Northwest Lab., Richland, WA (USA)). Oct 1988. Contract AC06-76RL01830. 725p. NTIS, PC A99/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005483/JAW.

The purpose of this report is to formally document the assessment activities at the US Department of Energy (DOE) Hanford Site. These activities were carried out pursuant to the DOE orders that address the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Program for the cleanup of inactive waste sites. The DOE orders incorporate the US Environmental Protection Agency methodology, which is based on the Superfund Amendments and Reauthorization Act of 1986. This methodology includes: PA/SI, remedial investigation/feasibility study, record of decision, design and implementation of remedial action, operation and monitoring, and verification monitoring. Volume 1 of this report discusses the CERCLA inactive waste-site evaluation process, assumptions, and results of the Hazard Ranking System methodology employed. Volume 2 presents the data on the individual CERCLA engineered-facility sites at Hanford, as contained in the Hanford Inactive Site Surveillance (HISS) Data Base. Volume 3 presents the data on the individual CERCLA unplanned-release sites at Hanford, as contained in the HISS Data Base. 13 refs.

10808 **(PNL—6456-Vol.3) Hazard ranking system evaluation of CERCLA inactive waste sites at Hanford: Volume 3: Unplanned-release sites (HISS data base).** Jette, S.J.; Lamar, D.A.; McLaughlin, T.J.; Sherwood, D.R.; Van Houten, N.C.; Stenner, R.D; Cramer, K.H.; Higley, K.A. (Pacific Northwest Lab., Richland, WA (USA)). Oct 1988. Contract AC06-76RL01830. 303p. NTIS, PC A14/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005484/JAW.

The purpose of this report is to formally document the assessment activities at the US Department of Energy (DOE) Hanford Site. These activities were carried out pursuant to the DOE orders that address the Comprehensive Environmental Response, and Liability Act (CERCLA) Program for the cleanup of inactive waste sites. The DOE orders incorporate the US Environmental Protection Agency methodology, which is based on the Superfund Amendments and Reauthorization Act of 1986. This methodology includes:PA/SI, remedial investigation/feasibility study, record of decision, design and implementation or remedial action, operation and monitoring, and verification monitoring. Volume 1 of this report discusses the CERCLA inactive waste-site evaluation process, assumptions, and results of the Hazard Ranking System methodology employed. Volume 2 presents the data on the individual CERCLA engineered-facility sites at Hanford, as contained in the Hanford Inactive Site Surveillance (HISS) Data Base. Volume 3 presents the data on the individual CERCLA unplanned-release sites at Hanford, as contained in the HISS Data Base. 13 figs.

10809 **(PNL—6704) Vitrification technologies for Weldon Spring raffinate sludges and contaminated soils: Phase I report: Development of alternatives.** Koegler, S.S.; Oma, K.H.; Perez, J.M. Jr. (Pacific Northwest Lab., Richland, WA (USA)). Dec 1988. Contract AC06-76RL01830. 35p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005507/JAW.

This engineering evaluation was conducted to evaluate vitrification technologies for remediation of raffinate sludges, quarry refuse, and contaminated soils at the Weldon Spring site in St. Charles County, Missouri. Two technologies were evaluated: in situ vitrification (ISV) and the joule-heated ceramic melter (JHCM). Both technologies would be effective at the Weldon Spring site. For ISV, there are two processing options for each type of waste:

vitrify the waste in place, or move the waste to a staging area and then vitrify. The total time required to vitrify raffinate sludges, quarry refuse, and contaminated soil is estimated at 5 to 6 years, with operating costs of $65.7M for staged operations or $110M for in-place treatment. This estimate does not include costs for excavation and transportation of wastes to the staging location. Additional tests are recommended to provide a more in-depth evaluation of the processing options and costs. For the JHCM process, about 6.5 years would be required to vitrify the three waste types. Total operating costs are estimated to be $73M if the glass is produced in granular form, and $97M if the glass is cast into canisters. Costs for the excavation and transportation of wastes are beyond the scope of this study and are not included in the estimates. Additional tests are also recommended to better define technical issues and costs. 10 refs., 2 figs., 5 tabs.

10810 **(PNL—6728) Geohydrologic characterization of the area surrounding the 183-H Solar Evaporation Basins.** Liikala, T.L.; Aaberg, R.L.; Aimo, N.J.; Bates, D.J.; Gilmore, T.J.; Jensen, E.J.; Last, G.V.; Oberlander, P.L.; Olsen, K.B.; Oster, K.R. (Pacific Northwest Lab., Richland, WA (USA)). Dec 1988. Contract AC06-76RL01830. 260p. NTIS, PC A12/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005508/JAW.

The purpose of this investigation is to achieve regulatory compliance with the applicable ground-water monitoring requirements of the Resource Conservation and Recovery Act (RCRA) and the Washington Administrative Code (WAC). An assessment-level compliance monitoring project was established for the 183-H Basins because hazardous waste constituents were known to have entered the ground water beneath the facility. Three phases were defined for this project, with work being concentrated in five areas: geology, hydrology, ground-water monitoring, geochemistry, and ground-water modeling. These characterization activities have resulted in the definition of principal lithologic and hydrostratigraphic units. Ground-water monitoring results indicated a contamination peak, which occurred between April and August 1986. Further monitoring has shown that nitrate, sodium, gross alpha, and gross beta are the clearest indicators of ground-water contamination attributable to the 183-H Basins. In addition, the concentrations of these contaminants are affected by variations in Columbia River stage. Future studies will focus on continued ground-water monitoring throughout the closure and post-closure periods for the 183-H Basins, sampling of the Columbia River and nearby groundwater springs, and soil sampling adjacent to the facility. 45 refs., 90 figs., 19 tabs.

10811 **(PNL-SA—15454) Corrosion of candidate container materials in air-steam mixtures.** Lutton, J.M.; Dewees, D.A.; Robinson, C.G.; Brehm, W.F.; Anantatmula, R.P. (Pacific Northwest Lab., Richland, WA (USA)). Nov 1987. Contract AC06-76RL01830. 14p. (CONF-871124—106). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005155/JAW.

From Fall meeting of the Materials Research Society; Boston, MA, USA (30 Nov 1987).

The environment during the operating period of a high-level nuclear waste repository in basalt is expected to be air saturated with steam. Liquid groundwater is not expected to be in contact with the container surface during that time. The report presents corrosion findings from tests conducted for one to twenty-five months in an air-steam environment. Tests were carried out with bare metal specimens exposed to an air atmosphere containing 12% moisture in chambers maintained at temperatures between 150{degree}C and 300{degree}C. Cast carbon steel exhibited total penetrations less than 0.002 mm for exposures up to 25 months. A ferritic alloy steel, Fe9Cr1Mo, showed corrosion results very similar to cast carbon steel. Unalloyed copper materials showed essentially linear corrosion rates, with total penetrations between 0.002 mm at 150{degree}C and 0.14 mm at 300{degree}C in 25 months. Cupronickel 90-10 exhibited total penetrations between 0.001 mm at 150{degree}C and 0.05 mm at 300{degree}C in 25 months. There was a tendency for the corrosion rate to increase with time for cupronickel at 250{degree}C and 300{degree}C possibly because of a mid-test change in the corrosion mechanism. Limited testing of specimens surrounded with bentonite/basalt packing material indicated that the presence of packing has no strong effect on the corrosion of iron-base materials; however, copper-base and cupronickel materials corroded at higher rates in the presence of packing, with a possible shift towards the lower bare specimen corrosion rates with increasing time. 8 refs., 5 figs., 3 tabs.

10812 **(PNL-SA—16366) Hazardous organic waste destruction by electrochemical oxidation.** Molton, P.M.; Fassbender, A.G.; Nelson, S.A.; Cleveland, J.K. (Pacific Northwest Lab., Richland, WA (USA)). Nov 1988. Contract AC06-76RL01830. 18p. (CONF-8811122—1). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004110/JAW.

From 13. annual environmental quality R and D symposium; Williamsburg, VA, United States (16 Nov 1988).

For these reasons, a project was funded to investigate an electrochemical method for oxidation of hazardous and mixed wastes. Electrochemical oxidation (ECO) has been successfully applied for destruction of very dilute solutions of chlorinated solvents in water, and for cleanup of more concentrated phenolic pulp wastes. Our work was intended to examine the ECO approach to destruction or organic wastes which are found on the Hanford site and in the Pacific Northwest generally. Not surprisingly, many of these wastes are also found elsewhere, particularly at military installations, as they comprise solvents, paints, laboratory chemicals, and other chemical processing wastes. 5 refs., 9 figs.

10813 **(PNL/SRP—6231) Experimental technique for sampling saturated brines from autoclaves: Application to the system NaCl-H_2O at 200{degree}C and 25 MPa: Salt Repository Project.** Erikson, R.L.; Hodges, F.N. (Pacific Northwest Lab., Richland, WA (USA)). Nov 1988. Contract AC06-76RL01830. 29p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004696/JAW.

A technique was developed to obtain multiple samples of salt- saturated hydrothermal brine from a Dickson autoclave system. The equipment was modified by replacing the standard sampling syringe with an external, small volume, pressure vessel that was maintained at the run temperature. A mass of water injected into the external vessel before sampling eliminated the possibility of rapid vaporization and precipitation of salt during sampling. This technique circumvents the problems reported in previous studies (e.g., Sourirajan and Kennedy 1962) involving precipitation of salts with large prograde solubilities inside of the sampling capillary tube. The sampling technique was verified by extracting three samples of saturated NaCl brine at 200{degree}C and 25 MPa at run durations of 1, 3, and 7 days. For these sampling periods, 25.45, 14.29, and 12.04 g of brine were sampled. The mass of brine sampled was measured by rinsing the sampling vessel with known masses of water and recording the total mass of diluted solution. The mass of brine sampled was controlled by varying the mass of water injected into the external sampling vessel prior to sampling. 13 refs., 14 figs., 2 tabs.

10814 **(PTB-SE—22) Yield of radioactive wastes in the Federal Republic of Germany - waste survey for the year 1987.** Brennecke, P.; Schuhmacher, J. (Physikalisch-Technische Bundesanstalt, Braunschweig (Germany, F.R.). Abt. Sicherstellung und Endlagerung Radioaktiver Abfaelle). Jun 1988. 60p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88756396/JAW.

On December 31, 1987, about 73200 waste packages - about 37900 m/sup 3/ - were stored in interim storage facilities. The unconditioned radioactive wastes amounted to about 8600 m/sup 3/. The volume of the conditioned radioactive wastes amounted to about 37900 m/sup 3/. Of this, the waste from nuclear research centres made up about 15000 m/sup 3/, the waste from the operation of nuclear power plants about 12000 m/sup 3/ and that from the reprocessing of spent fuel elements about 7500 m/sup 3/. A prognosis was also made of the future amount of conditioned radioactive wastes. According to this forecast, the cumulated waste package volume of radioactive wastes with negligible heat generation will be approximately in the order of 196300 m/sup 3/ up to the year 2000, whereas for heat-generating radioactive wastes a volume of about 5800 m/sup 3/ is estimated. These figures already express the waste volume reduction according to modern conditioning techniques. In 1987 a capacity of about 121000 m/sup 3/ for

the interim storage of radioactive wastes was available in the Federal Republic of Germany. On December 31, 1987, an average of about 35% of this capacity was utilized by unconditioned and conditioned radioactive wastes. From the data on the expected amount of radioactive wastes and on the utilization factor of the interim storage facilities, it may be concluded that, taking an overall view, no bottlenecks in the interim storage of radioactive wastes with negligible heat generation are to be anticipated up to the planned operation of the Konrad repository in 1993.

10815 **(SAND—87-1685) Preliminary evaluation of the exploratory shaft representativeness for the Yucca Mountain Project.** Nimick, F.B.; Shephard, L.E.; Blejwas, T.E. (Sandia National Labs., Albuquerque, NM (USA)). Dec 1988. Contract AC04-76DP00789. 134p. NTIS, PC A07/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005298/JAW.

Experiments planned in the Exploratory Shaft (ES) play an integral role in the site-characterization effort to provide the necessary information for evaluating the Yucca Mountain site as a potential high-level waste repository. An important part of the planning process for the ES is to evaluate the representativeness of the data and information to be obtained in the ES relative to the remainder of the area and environs. This evaluation is based on evolving interpretations of a limited suite of data, many of which were obtained adjacent to or outside the designated boundaries of the primary area. The representativeness of information scheduled to be obtained in the ES has been evaluated for a number of technical disciplines including geology, mineralogy, rock mechanics, hydrology, waste package and repository design, and performance assessment. The representativeness in some areas is considered in greater detail than in other areas because of the disparity in the amount of data available and the level of confidence in the data analysis and interpretation. Results of this evaluation indicate that most data obtained in the ES are expected to be representative of the primary area at Yucca Mountain. The conclusion also is drawn that the selected location of the ES is at least as good as any other single location within the primary area. 37 refs., 56 figs., 5 tabs.

10816 **(SAND—87-2070C) Preliminary preclosure radiological safety analysis for normal operations of a prospective Mucca Mountain repository.** Jardine, L.J.; Ma, C.W.; Hartman, D.J.; Sit, R.C.; Zavoshy, S.J.; Laub, T.W. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 18p. (CONF-880903—47). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005208/JAW.

From Spectrum '88: international topical meeting on nuclear and hazardous waste management; Pasco, WA, United States (11 Sep 1988).

A preliminary radiological safety analysis was performed for the normal operating conditions during the preclosure period at the prospective Yucca Mountain repository. Since the repository is designed to accommodate spent fuel and defense high-level waste (DHLW), an estimate was made of the offsite doses and onsite occupational doses from (1) anticipated routine releases of airborne radioactive materials and from (2) the handling of the spent fuels and DHLW. This paper summarizes the methodology and calculated offsite doses resulting from the postulated routine releases of airborne radioactive materials from the waste-handling building through inhalation and immersion pathways. The calculated onsite occupational doses from the inhalation, immersion, and direct exposure pathways will be reported elsewhere at a later date. 15 refs. , 4 tabs.

10817 **(SAND—88-1469) Consolidation of crushed rock salt: Part 1, Experimental results for dry salt analyzed using a hot-pressing model.** Holcomb, D.J.; Zeuch, D.H. (Sandia National Labs., Albuquerque, NM (USA)). Oct 1988. Contract AC04-76DP00789. 85p. NTIS, PC A05/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005300/JAW.

Mechanical properties of granulated rock salt are of interest in the underground disposal of nuclear waste because native salt from the excavations will be used as part of the backfill around the waste packages and in storage rooms, shafts and other openings. Backfill properties will be important in controlling room closure rates and local permeability. To obtain data on instantaneous and time-dependent compaction of crushed salt, we have done tests to measure the compaction as a function of time, temperature and pressure. Tests were done for a range of temperatures from 21 to 100{degree}C and pressures from 1.72 to 21 MPa, under quasistatic and creep conditions. All tests were done under hydrostatic loading, and also under nominally dry conditions, which means the only water present was the ~0.2% water content of the salt. We found that: (1) Volumetric creep consolidation under hydrostatic stress proceeds at a rate of approximately 0.01t/sup {minus}1/, where t is the time in seconds. Creep consolidation is a function of log(t) and is slow. (2) Consolidation is not very temperature dependent in the range 21{degree}C to 100{degree}C. (3) Results can be fit reasonably well by a model developed to describe isostatic hot-pressing. 42 refs., 14 figs.

10818 **(SAND—88-2761C) A relative risk comparison of criticality control strategies based on fresh fuel and burnup credit design bases.** Sanders, T.L. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 25p. (CONF-8810263—1; TTC—0851). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89003899/JAW.

From American Nuclear Society (ANS) tutorial session: burnup credit issues in spent fuel transportation; Washington, DC, USA (30 Oct 1988).

The proposed use of burnup credit in spent fuel cask design and operation represents a departure from current regulatory practice, and creates technical issues that ultimately must be resolved for the concept to be implemented. Issues related to specific technical considerations can generally be resolved conclusively. However, an underlying perception may still exist that the use of burnup credit compromises criticality safety. In practice, individual casks are designed to satisfy regulatory requirements in a generally conservative manner. The designer's application of the regulatory requirements involves some engineering judgement, as does the regulator's implementation of them. This does not have an adverse effect on safety, but does make it difficult to objectively compare new or alternative designs and/or operating approaches. 5 refs., 7 figs., 2 tabs.

10819 **(SKB-TR—87-32) Survey of Swedish buffer material candidates and methods for characterization.** Erlstroem, M.; Pusch, R. (Swedish Geological Co., Lund. Div. of Engineering Geology). (Swedish Nuclear Fuel and Waste Management Co., Stockholm). Dec 1987. 87p. NTIS (US Sales Only), PC A05/MF A01. Order Number DE88756528/JAW.

The study has given a good overview of potential clay buffer candidates in the part of Sweden that offers the best possibilities to find large accessible quantities of smectitic materials. The most promising Scanian materials are those in the Kaageroed and Vallaakra (Margreteberg) areas since they represent the most smectitic ones, which may serve as raw material for the production of canister embedment. The moraine clays in the Lund-Landskrona region seem to be useful for backfilling purposes. A refined version of Reynolds technique is suggested as an SKB standard for prospecting and characterization of buffer materials.

10820 **(SKB-TR—88-03) Flow and solute transport in a single fracture. A two-dimensional statistical model.** Moreno, L.; Neretnieks, I.; Tsang, Y.; Tsang, C.F. (Royal Inst. of Tech., Stockholm (Sweden). Dept. of Chemical Engineering; California Univ., Berkeley (USA). Earth Sciences Div.). (Swedish Nuclear Fuel and Waste Management Co., Stockholm). Jan 1988. 51p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88756530/JAW.

A two-dimensional model for a single fracture with variable apertures is presented. The spatial variation of the apertures in the fracture is defined by the aperture density distribution and the spatial correlation length. Flow and solute transport in the generated fractures are simulated. The simulated flow is unevenly distributed in the fracture and the flow rates may vary by several orders of magnitude. Cubic law fracture apertures are also calculated and are smaller than the mass balance fracture apertures. The pressure field in the fracture is calculated, in which great differences exist be-

tween this pressure and the pressure field for a fracture with constant aperture. The solute transport is studied using the particle tracking technique. Breakthrough curves for nonsorbing and sorbing species are simulated. The sensitivity of the two-dimensional model is studied by generating fractures with different parameters in the density distribution function, different correlation lengths, and different number of nodes used in one correlation length. The flow is strongly reduced when the simulated normal stress is increased. The cubic law fracture aperture may be several orders of magnitude smaller than the mass balance fracture aperture.

10821 **(SKB-TR—88-10) GWHRT - a flow model for coupled groundwater and heat flow. Version 1.0.** Thunvik, R.; Braester, C. (Royal Inst. of Tech., Stockholm (Sweden); Technion-Israel Inst. of Tech., Haifa). (Swedish Nuclear Fuel and Waste Management Co., Stockholm; Royal Inst. of Tech., Stockholm (Sweden); Technion-Israel Inst. of Tech., Haifa). Apr 1988. 203p. NTIS (US Sales Only), PC A10/MF A01. Order Number DE88756533/JAW.

A mathematical model describing the hydrothermal conditions around a hard rock repository for disposal of nuclear waste is presented. The model was developed to study the effect of heat released from a waste repository on the flow times from the repository to the ground surface. The model consists of a set of coupled non-linear partial differential equations for heat and ground water flow. In addition there are two equations of state relating fluid density and viscosity to pressure and temperature. The system of equations is solved numerically using the finite element method in one, two or three dimensions. The model has been successively developed and used as a research tool to include unsaturated flow, gas migration, discrete elements, stochastic analysis, etc. The model version described here is the basic one. The fractured rock is treated either as two overlapping continua in which the one represents the network of fractures and the other the solid blocks or as a single equivalent medium. The first approach assumes quasi-steady state heat transfer from the rock to the fluid, allowing a linear heat transfer function to be used. The second approach assumes instantaneous equilibrium between the fluid and the rock.

10822 **(USGS-OFR—88-243) High-precision gravity network to monitor temporal variations in gravity across Yucca Mountain, Nevada.** Harris, R.N.; Ponce, D.A. (Geological Survey, Menlo Park, CA (USA)). 1988. Contract AI08-78ET44802. 19p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number TI89005023/JAW.

Repeatable high-precision gravity surveys provide a method of monitoring temporal variations in the gravity field. Fluctuations in the gravity field may indicate water table changes, crustal deformation, or precursors to volcanism and earthquakes. This report describes a high-precision gravity loop which has been established across Yucca Mountain, Nevada in support of the Nevada Nuclear Waste Storage Investigations (NNWSI) program. The purpose of this gravity loop is to monitor temporal variations in gravity across Yucca Mountain in an effort to interpret and predict the stability of the tectonic framework and changes in the subsurface density field. Studies of the tectonic framework which include volcanic hazard seismicity, and faulting studies are in progress. Repeat high-precision gravity surveys are less expensive and can be made more rapidly than a corresponding leveling survey. High-precision gravity surveys are capable of detecting elevation changes of 3 to 5 cm, and thus can be employed as an efficient tool for monitoring vertical crustal movements while supplementing or partially replacing leveling data. The Yucca Mountain gravity network has been tied to absolute gravity measurements established in southern Nevada. These ties provide an absolute datum for comparing repeat occupations of the gravity network, and provide a method of monitoring broad-scale changes in gravity. Absolute gravity measurements were also made at the bottom and top of the Charleston Peak calibration loop in southern Nevada. These absolute gravity measurements provide local control of calibrating gravity meters over the gravity ranges observed at Yucca Mountain. 13 refs., 7 figs., 3 tabs.

10823 **(WHC-EP—0045-Rev.1) Hanford Waste Vitrification Plant preliminary waste form qualification plan - FY 1988 update.** Nelson, J.L. (Westinghouse Hanford Co., Richland, WA (USA)). Sep 1988. Contract AC06-87RL10930. 78p. NTIS, PC A05/MF A01 - OSTI. Order Number DE89004657/JAW.

The objective of this plan is to identify the basic steps, activities, interactions, milestones, proposed schedule, and cost estimates needed to ensure that the Hanford Waste Vitrification Plant (HWVP) defense high-level waste glass product will be acceptable for disposal in the candidate geologic repository. This plan covers activities required for the qualification of vitrified Neutralized Current Acid Waste (NCAW) and provides a schedule of activities leading up to the vitrification of Complexed Concentrate (CC) and Plutonium Finishing Plant (PFP) wastes. Future revisions of the Waste Form Qualification (WFQ) Plan will address other Hanford Site wastes expected to be vitrified at the HWVP. The scope of the plan encompasses interaction with the following sites: the Defense Waste Processing Facility (DWPF) at Savannah River, South Carolina and the West Valley Demonstration Project (WVDP) at West Valley, New York; and the candidate repository site in Nevada. Precedents set by the WFQ activities at the DWPF have been considered in the development of this plan. Future revisions to this plan will reflect the determination of common HWVP and DWPF activities as technical exchanges between HWVP and DWPF continue. For activities already identified as common between the DWPF and HWP, this qualification plan utilizes information directly from the DWPF Waste Form Compliance Plan (WCP), as mandated by the HWVP technology development charter. 12 refs., 2 figs., 6 tabs.

10824 **(WHC-EP—0133) U1/U2 uranium plume characterization, remedial action review and recommendation for future action.** Baker, S.M.; Devary, J.L.; Elmore, R.P.; Lorang, R.F.; Rossi, A.J.; Freshley, M.D. (Westinghouse Hanford Co., Richland, WA (USA)). Jun 1988. Contract AC06-87RL10930. 71p. NTIS, PC A04/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004660/JAW.

Research topics include: the need for additional characterization of a uranium groundwater plume associated with the 216-U-1 and 216-U-2 cribs(U1/U2 cribs); regulatory requirements for cleaning up the plume beyond the cleanup already completed; the technical feasibility and cost of additional cleanup by pumping and processing groundwater. Conclusions resulting from these investigations include additional characterization of the uranium contaminant plume and other nearby contaminant plumes is required before resuming groundwater pumping to cleanse the aquifer below the U1/U2 cribs, and future groundwater pumping to clean up the aquifer should not be performed without prior agreement with the US Environmental Protection Agency and the State of Washington Department of Ecology. Specifically, negotiations with the regulatory agencies should establish the need for, and appropriateness of, any proposed groundwater pumping. 4 figs., 5 tabs.

10825 **(WHC-EP—0140) Hanford Waste Vitrification Plant Project advanced conceptual design summary report.** Anderson, T.D. (Westinghouse Hanford Co., Richland, WA (USA)). Nov 1988. Contract AC06-87RL10930. 51p. NTIS, PC A04/MF A01 - OSTI. Order Number DE89004658/JAW.

The Hanford Waste Vitrification Plant (HWVP) will immobilize Hanford defense liquid high-level waste in borosilicate glass in preparation for shipment to a geologic repository. The shipment of the waste to the repository will satisfy an objective in the President's Defense Waste Management Plan. The glass product will be cast into stainless steel canisters, which will be sealed and stored at Hanford until they are shipped. This document summarizes work performed during the Advance Conceptual Design (ACD) of the HWVP. In the Reference Conceptual Design phase, which preceded the ACD, a number of design issues were identified with the potential to improve cost effectiveness, safety, constructibility, and operability. The ACD addressed and evaluated these design issues. Implementation of recommendations derived from ACD work will occur in subsequent design phases. The next design phase is preliminary design which will be followed by de-

tailed design and construction. Net potential cost improvements of more than $36.9M were identified along with improvements in safety, constructibility, and operability. No negative schedule impacts will result from implementation of the improvements. 11 refs., 5 figs., 3 tabs.

10826 **(WHC-EP—0179) Best available technology equivalent controls for B Plant Process Condensate: Tank farm process technology section.** (Westinghouse Hanford Co., Richland, WA (USA)). Nov 1988. Contract AC06-87RL10930. 34p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89004661/JAW.

This report evaluates whether proposed controls for the B Plant Process Condensate effluent stream are equivalent to Best Available Technology (BAT) economically achievable. Methods to determine whether the proposed controls for the BCP were equivalent to BAT originated from the Guidance Document for the Hanford Site. The BAT performance standards, which originate from the Clean Water Act, are to be applied to all contaminated liquid effluent discharges currently going to the soil column at the Hanford Site. The B Plant BAT evaluation addressed pollutants that had not been regulated traditionally under Federal or State water-pollution control programs. As a result, only comparisons could be made to existing radiation and water quality standards, and a BAT determination based on the effluent guidelines method (as outlined in the BAT Guidance Document) was not possible. Due to the variability and inconsistency of factors with comparable streams, such as the effluent stream at the Savannah River Plant, a BAT determination by the technology transfer method and treatability studies method was not possible. By using the generic treatment systems method, a one-or two-stage treatment system for dissolved solids removal was concluded to be equivalent to BAT. By performing two economic achievability tests, a one-stage treatment system consisting of mixed bed ion exchange columns was considered to be cost effective and equivalent to BAT. 13 refs., 4 figs., 5 tabs.

10827 **(WHC-EP—0196-1) Annual status report of the plan and schedule to discontinue disposal of contaminated liquids into the soil column at the Hanford site.** Stordeur, R.T.; Flyckt, D.L. (Westinghouse Hanford Co., Richland, WA (USA)). Sep 1988. Contract AC06-87RL10930. 68p. NTIS, PC A04/MF A01 - OSTI. Order Number DE89004659/JAW.

A review is presented of the approach that established the Phase I and II priorities. This review was necessitated by changes in the key assumptions, including the recent decision to place N Reactor in cold standby. A revised priority listing, based on current information, identified 19 Phase I streams. This list is compared to the original with its 16 Phase I streams. The net increase in three Phase I streams results from five upgrades (II to I) plus one new stream (which is a Phase I), minus three downgrades (I to II). The estimated cost for providing alternative treatment systems for the 19 Phase I projects is currently $110 million. In the March 1987 Plan and Schedule, the total Phase I costs were between $75 and $143 million. The original cost estimate for final disposal of the secondary wastes was between $54 and $65 million. The latest cost estimate is $22 million. Capital funding for the majority of these projects will be provided by the Hanford Environmental Compliance (HEC) line item. 14 refs., 4 figs., 10 tabs.

0530 Environmental Aspects

REFER ALSO TO CITATION(S) 10756, 10757, 10762, 10763, 10764, 10765, 10766, 10767, 10768, 10769, 10770, 10771, 10772, 10773, 10774, 10775, 10776, 10777, 10778, 10779, 10780, 10782, 10784, 10786, 10787, 10788, 10789, 10799, 10800, 10801, 10802, 10805, 10806, 10807, 10808, 10809, 10810, 10812, 10813, 10815, 10816, 10817, 10818, 10822, 10824, 10827, 10828, 10829

0540 Health And Safety

REFER ALSO TO CITATION(S) 10806, 10807, 10808, 10824

10828 **(DOE/HWP—72) Proceedings of the remedial investigation/feasibility study workshop.** (Oak Ridge National Lab., TN (USA)). Dec 1988. Contract AC05-84OR21400. 234p. (ORNL/M—665; CONF-8808110—Summ.). NTIS, PC A11/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004242/JAW.

From Remedial investigation/feasibility study workshop; Salt Lake City, UT, USA (9 Aug 1988).

The objective of this workshop was to familiarize Department of Energy (DOE) personnel and contractors with all aspects of developing, managing, and conducting an RI/FS, based on HAZWRAP SCO experience in similar activities as part of the Installation Restoration program (IRP). The HAZWRAP SCO participation in Department of Defense (DOD) restoration activities provides an opportunity to develop capability and experience which are transferable to DOE activities. Paul Franco, Program Manager for the IRP, provided an overview of the IRP experience in conducting an RI/FS for a National Priorities List (NPL) site and a non-NPL site. A non-NPL site does not require an RI/FS by regulation; however, the RI/FS process can be used to determine whether to proceed with a feasibility study or terminate the action with a decision document. Al Porell, Program Manager for ICP, discussed the use of decision documents to remove non-NPL sites from regulatory consideration. DOE-Idaho has used similar documentation to remove numerous sites from their list of potential remedial action sites. Mr. Porell also discussed the use of the Technical Review Committee (TRC), which is established to coordinate activities during the RI/FS process. The TRC includes state, local, and federal authorities, and Air Force installation personnel.

10829 **(EGG-M—88190) Corrective action investigation of mixed waste contaminated percolation pond.** Van Deusen, L.C.; Monnot, D.R.; Hull, L.C.; Davis, K.D.; Weiler, F.H.; Sheldon, D.E. (EG and G Idaho, Inc., Idaho Falls (USA)). 1988. Contract AC07-76ID01570. 7p. (CONF-881054—43). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005279/JAW.

From 4. annual DOE model conference; Oak Ridge, TN, USA (3 Oct 1988).

The Idaho National Engineering Laboratory (INEL), located in southeast Idaho and operated by the Department of Energy (DOE), has had the largest number of nuclear reactors during its lifetime of any location in the United States. The Test Reactor Area (TRA), one facility within the INEL, has been the home of three major test reactors, one of which is still operational. The TRA Warm Waste Pond is a three-celled percolation pond that has received waste water from these reactor operations since 1952. The pond is estimated to have received over 27,700 lbs of chromium in addition to about 5.2 {times} 10^4 curies of radioactive materials. Because of known migration of contaminants to a perched-water zone, the pond is scheduled for corrective actions under a Resource Conservation and recovery Act (RCRA) Consent Order and Compliance Agreement with Region X, Environmental Protection Agency (EPA). The pond will probably be included on the National Priority List by the spring of 1989. Field investigations were initiated in 1987 and continued in 1988 to pursue possible corrective or remedial actions. This paper describes the efforts to date, including a description of the unique problems and physical restrictions associated with sampling the pond while it is in use and sampling through the gravel and cobblestones that line the pond. 6 refs., 1 fig.

10830 **(PNL-SA—15488) A Bayesian sampling strategy for hazardous waste site characterization.** Skalski, J.R. (Pacific Northwest Lab., Richland, WA (USA)). Dec 1987. Contract AC06-76RL01830. 15p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005534/JAW.

Prior knowledge based on historical records or physical evidence often suggests the existence of a hazardous waste site. Initial surveys may provide additional or even conflicting evidence of site contamination. This article presents a Bayes sampling strategy that allocates sampling at a site using this prior knowledge. This sampling strategy minimizes the environmental risks of missing chemical or radionuclide hot spots at a waste site. The environmental risk is shown to be proportional to the size of the undetected hot spot or inversely proportional to the probability of hot spot detection. 12 refs., 2 figs.

10831 **Mortality among workers at a nuclear fuels production facility.** Cragle, D.L.; McLain, R.W.; Qualters, J.R.; Hickey, J.L.; Wilkinson, G.S.; Tankersley, W.G.; Lushbaugh, C.C. (Oak Ridge Associated Universities, TN (USA)). *American Journal of Industrial Medicine;* **14**: No. 4, 379-401(1988).

A retrospective cohort mortality study was conducted in a population of workers employed at a facility with the primary task of production of nuclear fuels and other materials. Data for hourly and salaried employees were analyzed separately by time period of first employment and length of employment. The hourly (N = 6687 with 728 deaths) and salaried (N = 2745 with 294 deaths) employees had a mortality experience comparable to that of the United States and, in fact, exhibited significant fewer deaths in many categories of diseases that are traditionally associated with the healthy worker effect. Specifically, fewer deaths were noted in the categories of all causes, all cancers, cancer of the digestive organs, lung cancer, brain cancer (hourly workers only), diabetes, all diseases of the circulatory system, all respiratory diseases, all digestive system diseases, all diseases of the genitourinary system (hourly only), and all external causes of death. A statistically significant, and as yet unexplained increase in leukemia mortality (6 observed vs. 2.18 expected) appeared among a subset of the hourly employees, first hired before 1955, and employed between 5-15 years.

0550 Safeguards, Inspection, And Accountability

REFER ALSO TO CITATION(S) 10823

10832 **(CONF-8810269—1) Process data in safeguards at the Oak Ridge National Laboratory.** Ehinger, M.H. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 15p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89002234/JAW.

From Institute of Nuclear Materials Management technical workshop on integrated safeguards; Albuquerque, NM, USA (17 Oct 1988).

The desire to improve timeliness and sensitivity of material control and accounting capabilities is the basis for evaluation and upgrade of regulatory requirements throughout the nuclear industry. Improvements invariably require better measurement capabilities and more frequent measurements. Operating plants typically include a broad range of measurements and equipment devoted to process control. How can these measurements be used to benefit safeguards? A part of the Consolidated Fuel Reprocessing Program at the Oak Ridge National Laboratory has focused on the use of process data for safeguards. This report discusses recent safeguards demonstrations and current activities in a test facility at Oak Ridge.

10833 **(DOE/NE—0096) Program plan FY 1989: Surplus facilities management program.** (USDOE Assistant Secretary for Nuclear Energy, Washington, DC. Office of Remedial Action and Waste Technology). Nov 1988. 72p. NTIS, PC A04/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005515/JAW.

The Program Plan is a key document of the Surplus Facility Management Program (SFMP). The Program Plan describes the program's mission and objectives; describes the program approach to decommissioning; describes the management approach; outlines program documentation; and presents current program baseline information. The Program Plan does not address, in detail, the project-level activities conducted by participating DOE Operations Offices. Each Operations Office is responsible to organize, manage, and conduct their activities in accordance with DOE guidance and directives in support of the SFMP mission and objectives. Three appendixes are included within this Program Plan. Appendix A gives a listing of past and current surveillance and maintenance tasks. Appendix B provides a description of current SFMP facilities that have been identified for disposition (i.e., projects) at sites throughout the United States. Appendix C shows the current SFMP Project Cost and Schedule Baseline. Other key program documents include the Resource Manual and the Yearly Management Plan. These documents are subordinate to the Program Plan. The Resource Manual details program requirements, provides pertinent DOE references and guidance, and supplies the pertinent forms used to manage the decommissioning of surplus facilities. The Yearly Management Plan focuses on the established annual milestones, planned and achieved accomplishments, and baseline costs and schedules. 4 figs.

10834 **(NUREG—1329) Entry/exit control at fuel fabrication facilities using or possessing formula quantities of strategic special nuclear material.** Dwyer, P.A. (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Safeguards and Transportation). Dec 1988. 17p. NTIS, PC A03/MF A01 - GPO - OSTI. Order Number TI89004554/JAW.

This document presents information on entry/exit control at fuel fabrication facilities using or possessing formula quantities of strategic special nuclear material. It describes NRC requirements and methods for conducting personnel, package, and vehicle searches at these facilities. Testing methods for determining the detection capability of firearms, explosives, and metal detectors are provided.

10835 **(WHC-SA—0169) Hanford Chemical Processing Accountability System upgrade.** Keck, R.D.; McRae, L.P. (Westinghouse Hanford Co., Richland, WA (USA)). Oct 1987. Contract AC06-87RL10930. 8p. (CONF-871110—27). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004908/JAW.

From 3. international conference on facility operations safeguards interface; San Diego, CA, USA (29 Nov 1987).

The upgrading of the existing computer-aided manual nuclear material accountability system in the 200 Areas of the Hanford Site is planned. A three-phase upgrade plan has been developed that provides completely computerized nuclear material accountability, automated tracking of significant items of material, and monitoring of the chemical processes. The system design will utilize a three-step material movement method and will stress ease of operation for the system users. The upgrade is currently in the early detailed-design phase.

0560 Legislation And Regulations

REFER ALSO TO CITATION(S) 10745, 10746, 10747, 10748, 10749, 10750, 10823

10836 **(INFO—0191) Regulation of uranium refineries and conversion facilities in Canada.** Didyk, J.P. (Atomic Energy Control Board, Ottawa, Ontario (Canada)). Apr 1986. 23p. (CONF-8604358—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705116/JAW.

From Technical committee meeting on advances in uranium refining and conversion; Vienna, Austria (7 Apr 1986).

The nuclear regulatory process as it applies to uranium refineries and conversion facilities in Canada is reviewed. In the early 1980s, Eldorado Resources Limited proposed to construct and operate new facilities for refining yellowcake and for the production of uranium hexafluoride (UF/sub 6/). These projects were subject to regulation by the Atomic Energy Control Board (AECB). A description of the AECB's comprehensive licensing process covering all stages of siting, construction, operation and eventual decommissioning of nuclear facilities is traced as it was applied to the Eldorado projects. The AECB's concern with occupational health and safety, with public health and safety and with the protection of the environment in so far as it affects public health and safety is emphasized. Some regulatory difficulties encountered during the project's development which led to opening up the licensing process to public input and closer coordination of regulatory activities with

other provincial and federal regulatory agencies are described. The Board's regulatory operational compliance program for uranium refineries and conversion facilities is summarized.

07 ISOTOPE AND RADIATION SOURCE TECHNOLOGY

0701 Physical Isotope Separation

REFER ALSO TO CITATION(S) 11820

10837 (INIS-mf—11332, pp 36) **Evaluation of the radioisotope production for industrial uses.** Bilge, A.N.; Yavuz, H.; Tugrul, B. (Istanbul Technical Univ. (Turkey). Inst. for Nuclear Energy). 1988. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705189/JAW. (CONF-8809213—).

From IAEA Meeting: 10th European TRIGA users' conference; Vienna, Austria (14 Sep 1988).

0702 Radiation Sources

REFER ALSO TO CITATION(S) 11651

0704 Economics

REFER ALSO TO CITATION(S) 11887

08 HYDROGEN

REFER ALSO TO CITATION(S) 11192

10838 **(DOE/CE—0242) Hydrogen Energy Coordinating Committee annual report: Summary of DOE hydrogen programs for FY 1988.** (USDOE Assistant Secretary for Conservation and Renewable Energy, Washington, DC. Biofuels and Municipal Waste Technology Div.). Jan 1989. 44p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005289/JAW.

The FY 1988 Summary is the eleventh consecutive yearly report providing an overview of the hydrogen-related programs of the DOE offices represented on the HECC. A historical summary of the hydrogen budgets of these offices is given. The distribution by mission-related program element for FY 1988, and the non-mission-related activities are given. Total DOE funding in FY 1988 for mission-related hydrogen research was $5.2 million; DOE non-mission-related hydrogen research funding totaled $30.0 million. The individual program elements are described in the body of this report, and more specific program information is given in the Technology Summary Forms in Appendix A. 2 tabs.

0801 Production

10839 **(DOE/MC/22060—2643) Gas separation by pressure swing adsorption for producing hydrogen from coal: Final report.** Kapoor, A.; Ritter, J.A.; Yang, R.T. (State Univ. of New York, Buffalo (USA). Dept. of Chemical Engineering). Feb 1988. Contract AC21-85MC22060. 204p. NTIS, PC A10/MF A01 - OSTI; 1; GPO Dep. Order Number DE89000919/JAW.

This project demonstrated the feasibility of producing high purity hydrogen from a coal gasification product gas mixture by Pressure Swing Adsorption (PSA) using a commercial 5A zeolite as the adsorbent. The major advantage of PSA over conventional hydrogen upgrading processes is associated with lower overall production costs. This is mainly due to the integration of PSA into H_2 production plants as a single unit operation by replacing the low temperature carbon monoxide shift, carbon dioxide wash and methanation steps. In this way, hydrogen production costs are typically reduced from 7 to 40%. A single bed PSA process was designed to simulate the various steps of commercial multibed PSA plants. A new and very important step, "Vacuum Purge", was also investigated. 45 refs., 38 figs., 50 tabs.

0805 Safety

10840 **(N—89-10123) Technology issues associated with fueling the national aerospace plane with slush hydrogen.** Hannum, N.P. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). 1988. 9p. (NASA-TM—101386; E—4445; NAS—1.15:101386; CONF-890102—). NTIS, PC A02/MF A01.

From ASME energy-sources technology conference and exhibition and 7. intersociety cryogenic symposium; Houston, TX, USA (22 Jan 1989).

The National Aerospace Plane is a horizontal takeoff and landing, single stage-to-orbit vehicle using hydrogen fuel. The first flights are planned for the mid 1990's. The success of this important national program requires advances in virtually every discipline associated with both airbreathing and space flight. The high heating value, cooling capacity, and combustion properties make hydrogen the fuel of choice, but low density results in a large vehicle. Both fuel cooling capacity and density are increased with the use of slush hydrogen and result in significant reductions in vehicle size. A national program to advance this technology and to find engineering solutions to the many design issues is now under way. The program uses the expertise of the cryogenics production and services industry, the instrumentation industry, universities and governments. The program will be discussed to highlight the major issues and display progress to date.

09 OTHER SYNTHETIC AND NATURAL FUELS

0901 Hydrocarbon Fuels

REFER ALSO TO CITATION(S) 10885, 10896

10841 **(CONF-8809192—1) Experiments on low gravity droplet combustion.** Avedisian, C.T.; Yang, J.C. (Cornell Univ., Ithaca, NY (USA). Sibley School of Mechanical and Aerospace Engineering). 1988. Contract AC02-83ER13092. 16p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89003410/JAW.

From 3. international colloquium on drops and bubbles; Monterey, CA, USA (18 Sep 1988).

A small-scale (7.6m) drop water tower was used for studying the combustion of unsupported fuel droplets (about 500μm initial diameter) in a stagnant ambience under very low gravity. The droplets were observed over the period of burning from ignition to burnout. The experimental procedure consisted of generating a droplet in a near vertical trajectory and then releasing the chamber within which the droplet was introduced, as well as associated instrumentation, into freefall when the droplet reached the apex. A review of some results are presented for droplets consisting of single component liquids (toluene and heptane) and a binary miscible mixture of heptane and hexadecane. The evolution of droplet diameter is reported and comparisons with prior experiments are made. 17 refs., 5 figs.

10842 **(DTH-LET-RE—88-2) Gas boiler. A two-phased boiler system for the production of gas.** Henriksen, U.; Schramm, J.; Kofoed, E. (Danmarks Tekniske Hojskole, Lyngby. Lab. for Energiteknik). Jun 1988. 24p. (In Danish). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755763/JAW.

The aim was to modify a two-phased boiler for the production of a gas that could be used as a motor fuel. When beechwood was used as fuel for the boiler, gasification took place without blockage but the produced had a high wood-tar content and this caused blockage in the motor's induction system. When the boiler was stoked with Brassica napus (rape) and straw, the production of slag caused stoppage, in the boiler system. The tar content of the gas could not be reduced by increasing the induction and oxidation

zone temperature. The boiler was judged to be unsuitable for the production of gas fuel for motors. The retrofitting of the boiler is described and illustrated. (AB).

10843 **(NEI-DK—118) Achieving maximum production of biogas by instigating prior heating of the biomass and gas phase coupling.** Hamann Spendler, F. (Teknologisk Inst., Taastrup (Denmark). Bioteknik). Aug 1988. 48p. (In Danish). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755799/JAW.

It was attempted to determine the optimal prior heating time for raising, to 70 deg. C, the temperature of biomass composed of equal parts of pig and cattle manure in a biomass conversion plant. At the same time the effects of conveying gas produced to a biogas reactor were examined. The biomass was allowed to lie, and was added to, at varying intervals of time. It was shown that the concentration of volatile fatty acids, mainly acetic and propionic acid, increased after the heated manure was allowed to lie for 3 days. The maximum increase occurred after 1/2 day, and the content steadily declined up to the end of the third day the greatest increase of solute COD could be seen after 1/2 day at 7.9 gram per liter, equal to an increase of 39% in relation to the original material. After the same length of time the acid production was 1.9 gram per liter, and the greatest specific increase was 3.8 gram per liter per day. This proves that hydrolysis of particular materials to other products than volatile fatty acids occurs. After the biomass had lain for 1/2 day, gas production was 4,3 liter per 24 hrs per liter manure with following composition 87% CO2, 3.1% H2 and 0.35% CH4. Batch tests with heated fish waste indicate that if the mass is left for more than 4 days there is more potential methane in the heated than in the fresh biomass. The increase of methane potential to show that raising the temperature of biomass by letting it lie. "locks up" some composites in the manure the results of which are turned into methane. (AB).

10844 **(NEI-DK—119) Utilization of organic wastes from the fish industry to produce energy. Phase 2. Pilot project.** Balslev-Olesen, P.; Lynggaard-Jensen, A. (Vandkvalitetsinstituttet, Hoersholm (Denmark)). Sep 1988. 68p. (In Danish). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88755800/JAW.

It was aimed to determine the energy potential of organic wastes in superfluous liquids dispensed by the fish (primarily herring) industry. The construction of the demonstration system is described in detail, thus including the anaerobic filter, the fluid bed and the computerized control system and data collection. It is concluded that this form of industrial waste can be successfully cleansed by an anaerobic bioreactor simultaneously with the production of methane at the rate of 0.35 Nm3 methane per kilogram converted COD. The methane was composed of 2/3 methane, 1/3 carbon dioxide and 1.5% hydrogen sulphide. No problems arose where the liquid waste contained a salt concentration of between 1.2 and 2.0%. It was found that 75-95% of the COD content can be eliminated by anaerobic conversion. The bioreactor, anaerobic filter and fluid bed can be loaded with up to 10kg COD (m3.d), and it is possible to restart the process after an interval of three months. (AB).

10845 **(NRC/BS—NRCC18541) Methane from wastes.** van den Berg, L. (National Research Council of Canada, Ottawa, Ontario. Div. of Biological Sciences). 1980. 15p. (CE—02258). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

This booklet presents an introduction to the production of methane by anaerobic processes from organic wastes. It starts with a discussion of naturally occurring methanogenesis and the present-day use of anaerobic digestion in sewage treatment. The microbiology and biochemistry of methane production are then considered, with mention of the constraints on methane production caused by properties of methanogenic bacteria. Research is being conducted to improve methane production processes, and some new developments in this area are outlined. Advanced technologies available include: the anaerobic contact process, anaerobic filters, the anaerobic upflow sludge blanket reactor, fluidized bed processes, and the anaerobic fixed film reactor. The booklet concludes with a brief discussion of the suitability of methane producing technologies for small-scale operation in Canada. 12 refs., 5 figs., 3 tabs.

10846 **(PB—89-111868/XAB) Introduction of a new type of biogas fermentation-system design and its technology. Technical report.** Sun, J. (Beijing Agricultural Univ., BJ (China)). 1987. 15p. NTIS, PC E03/MF A01.

Contents include the following: fermentation technology, digester type, and general arrangement; improvement of fermentation-system sealing; improvement of stirring efficiency; keeping gas production under low and constant pressure; siphon tube for feeding and discharging; and thermal insulation measures and their efficiency calculation.

10847 **(PB—89-115505/XAB) Effect of preozonation on the anaerobic biodegradability of resistant phenolic compounds.** Wang, Y.T.; Pai, P.C.; Latchew, J.L. (Kentucky Univ., Lexington (USA). Water Resources Research Inst.). Aug 1988. 139p. (RR—169). NTIS, PC A07/MF A01.

Ozone pretreatment studies of four model phenolic compounds were conducted to evaluate the effects of ozonation on the anaerobic biodegradability and toxicity of these compounds. Two types of batch studies, the Biochemical Methane Potential (BMP) and the Anaerobic Toxicity Assay (ATA), were performed on samples ozonated upon phenol, o-cresol, 2,5-dichlorophenol and 2,4-dinitrophenol. Experimental results showed that toxic and refractory phenolic compounds were converted to methane gas by means of preozonation. In general, the biodegradable fraction of the oxidation products increased as the ozone dose was increased. The early ozonation products of o-cresol and phenol, however, were more toxic than the initial compounds. The rates of COD and Dissolved Organic Carbon (DOC) reduction through ozonation were faster and products formed were less inhibitory in the basic pH range than in the acid pH range.

10848 **(PB—89-120810/XAB) Advances in the use of biotechnology for municipal pollution control.** Venosa, A.D. (Environmental Protection Agency, Cincinnati, OH (USA). Water Engineering Research Lab.). 1988. 5p. (EPA—600/D-88/202). NTIS, PC A02/MF A01.

Pub. in United Nations Environment Programme Industry and Environment Review, 11-12(Dec 1987).

This paper summarizes progress in two of the biotechnology projects funded by WERL in recent years. The first deals with the cloning and DNA sequencing of the important genes responsible for methane production in methanogens. The second concerns the successful development of microbial binding proteins as cycling-column adsorbers for scrubbing pollutants such as cadmium and phosphate from waste water. Implications of results of the research in the Water Engineering Research Laboratory's research objectives are discussed.

10849 **(SV-US—1988-12) Vyrmethane method. Biogas extraction from peat bogs.** Brolin, L. (Swedish State Power Board, Vaellingby). 24 Feb 1988. 64p. (In Swedish). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88755917/JAW.

The Vyrmethane Method is based on the principle that the naturally gaseous water in the peat is pumped up and degassed in a vacuum tank. The gas is then led off and the water recirculated to the bog. On the basis of experience gained in conjunction with a pilot plant, it is judged that an area of about 10 ha is required in order to produce a gross output of 100 kW. In order to produce 100 kW of gas, some 15-20 kw of electricity is needed to power pumps and the degassing unit. In 1985 plans were made for constructing and operating a full-scale gas production plant for extracting biogas from Ske mosse. In 1986 a small pilot plant was established on Ske mosse. The plant covers an area of 50x400m (2 ha) and was designed to produce a volume of gas equivalent to an output of 10 kW. The pilot plant has not functioned in a satisfactory manner and has shown that the current technology has not been developed to a sufficient extent for it to be introduced on a commercial basis. The production price for gas delivered to the consumer, including gas distribution pipes has been calculated to be approximately SEK 0.31/kWh at a 6% real interest rate and over a

depreciation period of 15 years, for a full-scale plant on Ske mosse. In the case of a plant situated near a major consumer the production cost will be in the order of SEK 0.23/kWh, excluding the gas distribution pipes. These costs are based on values for gas production that were not verified in the pilot plant on Ske mosse. They are instead values that are judged possible to achieve in a well-functioning plant where the production of gas is high. The production costs for gas are far too high to make it possible at present to compete with other types of energy. A combination of the negative results from the pilot plant and the costs that have been estimated for a full-scale plant have meant that it has been decided not to continue with work on the Vyrmethane Method. (With 27 refs.)

0902 Alcohol Fuels

REFER ALSO TO CITATION(S) 10886, 11202, 11305

10850 (BEI—1980, pp 18) **The economics of ethanol manufacture.** Quittenton, R.C. 1980. CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada. (CONF-8006185—; CE—02121).

From Canadian national power alcohol conference; Winnipeg, Canada (20 Jun 1980).

In the preliminary parts of this paper, arguments are presented regarding the higher fuel value of ethanol vs gasoline, based on ethanol having a higher apparent work energy. In addition, certain facts are presented to counter the argument that producing ethanol from grain would decrease the food supply. The main part of this paper examines the state of fuel alcohol production and usage in Canada and the USA, including the cost of feedstock grains, alcohol plant costs, comparative synthetic fuels production costs, and government subsidies. In the USA, estimated cost per gallon would be ca $1.25 for a 1.5 million gal/d plant; current large-scale facilities charge prices of ca $1.80/gal. In the blending of ethanol into gasohol, under the current subsidy and price structure, blenders' end costs for alcohol and gasoline are the same, and the gain to the blender is an increase in gasoline supply. In Canada, such a situation would require a tax credit of 4 cents per liter. Taking into account subsidies for imported petroleum, investments in synfuel plants, tax concessions to the petroleum industry, and the fact that any gasohol subsidies would remain in Canada (unlike petroleum subsidies), it is concluded that a true gasohol subsidy cost in Canada would be 15-20 cents per liter, and would decrease as gasoline prices approached world price. In addition, fuel alcohol plants would require substantially lower capital investment per kJ of energy produced than synthetic fuels plants, would come onstream faster, and would be able to produce fuel indefinitely from a renewable resource. 1 fig., 5 tabs.

10851 (BEI—1980, pp 19) **Energy use optimization in ethanol plant design.** Husain, H.; Ho, C. (W.L. Wardrop & Associates, Ltd., Winnipeg, Man.). 1980. CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada. (CONF-8006185—; CE—02121).

From Canadian national power alcohol conference; Winnipeg, Canada (20 Jun 1980).

Energy consumption in ethanol manufacture is presently a subject of great interest as it has an important influence on the net energy balance of gasohol utilization. Figures quoted range from the most pessimistic based on historic operational data for distilleries, to most optimistic, for the latest process developments. This paper discusses the energy conservation features of a fuel alcohol plant using a conventional fermentation-distillation process. It is shown that energy consumption by a fuel alcohol plant need be only 50% of that for the average Canadian distillery (53 MJ/l in 1977). Further reductions are possible if more advanced but proven cooking and separation methods are selected. 3 figs.

10852 (BEI—1980, pp 16) **The non enzymatic hydrolysis of carbonates.** Hughes, J.F. 1980. CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada. (CONF-8006185—; CE—02121).

From Canadian national power alcohol conference; Winnipeg, Canada (20 Jun 1980).

A system has been developed, based on acid hydrolysis, to produce dextrose from starch in a reactor with a preheater, a high-speed high-shear nozzle, and collector. Data are presented to show that the dextrose equivalent increases linearly with operating temperature after the feed is passed through the nozzle. The temperature needed to get a specific dextrose equivalent was inversely dependent on the acid level, but upon reaching a certain acidity, no further benefit is obtained. After analyzing results of using this reactor, it was felt that the system could be used to produce fermentable substrates. Conventional brew syrups were tested for fermentability, and it was found that standard high pressure liquid chromatograph analysis was misleading in its analysis of sugars. After obtaining corrected values, it was seen that the process gave products at least equivalent to those made by the acid enzyme process; however, the system still had drawbacks for the manufacture of fuel alcohol. A revaluation of the equipment, with design changes, was carried out, so that a true yield against a designated dextrose equivalent and distribution could be obtained. This process, referred to as a soft process, gives true sugar distributions correlating directly to the theoretical yields as alcohol. Fermentability was greatly improved over the old process. The soft process has the following advantages over regular hydrolysis methods: it is continuous and does not require enzymes; it uses sterile media and is compatible to batch or continuous fermentation systems; and it has lower space requirements and lower capital cost. 9 figs., 6 tabs.

10853 (BEI—1980, pp 18) **Low energy alcohol process and alcohol from cellulose.** Frederickson, R.E.C. (Raphael Katzen Associates International, Inc., Cincinnati, OH). 1980. CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada. (CONF-8006185—; CE—02121).

From Canadian national power alcohol conference; Winnipeg, Canada (20 Jun 1980).

The Katzen low energy process for production of fuel grade anhydrous alcohol takes fermentation product, containing 7-8% alcohol, and preheats it using waste heat from other parts of the system. The preheated product is degassed and passed through a stripping/rectifying tower, which is the only part of the system that uses steam. Further steps include separation of by-products, dehydration, and condensation. The stillage is processed and sold as livestock feed. For a 189 million l/y plant, the thermal effciency of such a system is 63% (taking into account energy inputs into the plant and into corn farming), which is competitive with other conversion processes. This paper also describes the Gulf/University of Arkansas process for conversion of cellulosic materials to alcohol, a central feature of which is the simultaneous saccharification and fermentation of cellulose (SSF). A major advantage of this technology is its utilization of waste materials as feedstock. The SSF process is carried out continuously in 4 trains of fermenters; the alcohol recovery section is designed for maximum heat recovery and heat reuse, and stillage is processed for animal feed, as in the previously mentioned process. Technical feasibility has been demonstrated, and the commercial process economics, based on producing 50 million gal/y, shows a more favorable selling price than grain fermentation and synthetic alcohols with 100% investor equity financing. If such a plant is able to be financed with municipal bonds, because of its waste disposal capability, the economics become even more favorable. 4 refs., 5 figs., 3 tabs.

10854 (BEI—1980, pp 3) **[Advances in the conversion of lignocellulosics to ethanol].** Foody, P. (Techtrol Ltd., Montreal, Que.). 1980. CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada. (CONF-8006185—; CE—02121).

From Canadian national power alcohol conference; Winnipeg, Canada (20 Jun 1980).

Current cellulose-to-ethanol conversion technologies involve pretreatment, hydrolysis, fermentation, and distillation steps. This paper concentrates on aspects of the conversion process which can be optimized for best yield of the complete biomass. It is felt that the pretreatment step may be the single most important element in any successful conversion process. Some research projects in this area are outlined: increasing the accessible cellulose yield using steam explosion, improvement of acid hydrolysis by using a two-step process, and reducing the cost of producing enzymes for enzymatic hydrolysis. Another important factor in improving the economics of ethanol conversion is the value of by-products. Lignin is

examined as a marketable by-product, and cost figures given in this paper suggest viability of a plant whose main product is lignin and whose by-product is ethanol. In Ontario, feedstock for such a plant could come from hybrid poplar plantations, which could produce biomass for ca $12.50/ton under current conditions. Taking into account future advances in silviculture and microbiology, the equivalent cost of biomass based hydrocarbons could be cut to 10 cents per pound, resulting in an equivalent ethanol price of 65 cents per US gallon ($27/bbl equivalent).

10855 (BEI—1980, pp 9) **A microbiologist's view of fermentation.** Martin, S. (National Research Council). 1980. CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada. (CONF-8006185—; CE—02121).

From Canadian national power alcohol conference; Winnipeg, Canada (20 Jun 1980).

This paper discusses the microbial conversion of cellulose and the problems associated with pretreating and fermenting cellulosic materials. The resistance of cellulose, and associated substances such as lignin, to microbial attack means most alcohol production processes use some kind of pretreatment to convert cellulosic materials to a fermentable substrate. This paper outlines some research into the kinds of bacteria that can be used in single-step processes for producing ethanol from pretreated cellulosic substrates. One such organism is Clostridium thermocellum, which can convert cellulose to ethanol, but not very efficiently. New strains are being developed and their fermentation products analyzed, with a view to optimizing these and other organisms for ethanol production. Another field of investigation offering good possibilities is the co-culture technique; in one research project, thermocellum was paired with Clostridium thermosaccharalytium and showed promising ethanol yields.

10856 (BEI—1980, pp 14) **Power alcohol - the global picture.** Ward, R.F. (Biomass Energy, United Nations). 1980. CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada. (CONF-8006185—; CE—02121).

From Canadian national power alcohol conference; Winnipeg, Canada (20 Jun 1980).

Global production and use of ethanol and methanol is reviewed. World demand for ethanol and methanol are almost equal, between 12 and 13 million tonnes/y for each. Most ethanol is produced for beverage use by fermentation, but ca 45% of industrial alcohol supplies are produced from ethylene. Most of the world's methanol is produced by processes involving hydrogenation of CO. A number of countries have programs which encourage the production of these alcohols to extend gasoline supplies. The programs are often based on food crops which are subjected to wide variations in both cost and availability. One of the largest such programs is found in Brazil, which has promoted a major effort to add ethanol to gasoline and develop a local ethanol industry which bases its production mainly on sugar crops. In the USA, a number of research programs are investigating the hydrolysis of biomass residues for conversion to ethanol; current ethanol costs are not competitive with gasoline, but government incentives are being used to encourage its use as a transport fuel. Calculations are presented showing that, depending on the assumptions used, more petroleum may be used than saved in the production and utilization of ethanol. Methanol production operations have relatively high conversion efficiencies and generally lower feedstock costs, compared to ethanol production, resulting in a lower product cost (ca $0.20/l in 1980). Other alcohol programs are briefly described for Ireland, Jamaica, the Philippines, and some African countries. 26 refs., 1 fig.

10857 (BEI—1980, pp 11) **Methanol - the other alcohol - its production and use.** Mathers, D.E. (Manitoba Research Council). 1980. CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada. (CONF-8006185—; CE—02121).

From Canadian national power alcohol conference; Winnipeg, Canada (20 Jun 1980).

Methanol production from synthesis gas is outlined in this paper, with reference to Canadian conditions. Most synthesis gas for present and planned Canadian methanol production is made from natural gas by steam cracking. Other possible feedstocks for making synthesis gas are biomass and coal. Making synthesis gas from solid fuels is a complicated, energy-consuming process, but has the advantage that it can convert non-portable solid fuels to a relatively inexpensive portable liquid fuel; new processes, not yet demonstrated in Canada, could produce methanol at a cost between 35 and 65 cents per gallon. Research is being conducted in various countries on using methanol as an automotive fuel; some programs in Germany and the USA are briefly described. 11 refs., 6 figs., 1 tab.

10858 (BEI—1980, pp 10) **New production routes for power alcohol: ethanol production from hemicelluloses.** Flickinger, M.C.; Mehlberg, R.L.; Gong, C.S.; Chen, L.F.; Tsao, G.T. (Purdue Univ., West Lafayette, Indiana). 1980. CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada. (CONF-8006185—; CE—02121).

From Canadian national power alcohol conference; Winnipeg, Canada (20 Jun 1980).

Microbial conversion of carbohydrate-containing industrial cellulosic wastes and agricultural residues to fuel grade ethanol may be commercialized in the near future by by first fermenting the pentose sugar-containing hemicellulose fraction to alcohol. The advantages of this approach are: hemicelluloses can be easily hydrolyzed to monomers under mild conditions using a low liquid hydrolysis; these sugars can be recovered in a 15% syrup from the remaining lignocellulose; the yield of ethanol from pentoses can be high; hemicellulose has few competing markets and as such may be the least expensive fermentation carbohydrate available for conversion to fuel ethanol; and as cellulase enzyme production costs or acid recycle technology improves, conversion processes for the remaining cellulose could be added to an existing pentose ethanol facility. Initial pentose ethanol plant designs may dewater the lignocellulose residue for use as a solid fuel for process heat. This sugar fermentation technology may also be applied to grain alcohol production. Corn grain is 15% fiber predominantly hemicellulose with corn milling may allow conversion of both the starch and fiber carbohydrates to ethanol in a single yeast fermentation. This could increase alcohol produced from 2.5 to 3.0 gal/bu. Pentose conversion may also facilitate conversion of existing grain ethanol plants to cellulosic feedstocks. Additional alcohol may now be obtained from the pentoses in corn cobs or corn stover which could be transported to the plant along with the grain, or stored for processing when grain is not available. 8 refs., 5 figs., 2 tabs.

10859 (BEI—1980, pp 38) **Conventional fermentative ethanol production.** Zajic, J.E. (Univ. of Texas, El Paso). 1980. CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada. (CONF-8006185—; CE—02121).

From Canadian national power alcohol conference; Winnipeg, Canada (20 Jun 1980).

A review is made of the state of the art of ethanol production using conventional fermentation technology. Basic process diagrams for conventional fermentation processes are given, and the characteristics of yeasts used in beverage and food production are summarized. The major raw materials for use in alcohol production are sugars, grain starch, cellulosic materials, and by-product carbohydrates from food processing industries; certain materials may require conversion to fermentable sugar by hydrolysis. A number of specific processes using various materials are discussed: the simultaneous production of acetone, butanol, and ethanol by fermentation of molasses; ethanol from cassava roots; alcohol from prehydrolyzed lactose in whey; grain alcohol production; continuous fermentation processes for ethanol production from corn; and fermentative conversion of aspen wood. Control methods for assuring a high ethanol yield in the least possible time are outlined. Possibilities for improving ethanol production processes include breeding of cereals with high saccharide value, developing special yeasts, and optimizing the economics of the process through recovery of by-products. 25 refs., 14 figs., 12 tabs.

10860 (BEI—1980, pp 7) **Regulations covering ethanol and methanol manufacture and use in Canada.** Maclean, R.A. (Revenue Canada, Ottawa, Ont.). 1980. CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada. (CONF-8006185—; CE—02121).

From Canadian national power alcohol conference; Winnipeg, Canada (20 Jun 1980).

The regulations covering the manufacture and use of ethanol and methanol alcohols in Canada are embodied in the Excise Act and the regulations thereto. Wood alcohol (methyl alcohol) is nonpotable and not subject to excise duty. There are few regulations covering its manufacture and use. Manufacturers must obtain a licence for which the fee is $1.00 and they must provide a guarantee bond in the amount of $4,000. Ethyl alcohol is potable and subject to very high rates of duty. A distiller's licence is required to manufacture it. The licence fee is $250 per annum and a guarantee bond must be provided in the amount of $200,000 minimum. Ethyl alcohol may be denatured by the addition of denaturants that make it non-potable and prevent the recovery of the ethyl alcohol. Denatured alcohols are exempt from excise duty when intended for use as a fuel. It has been proposed that amendments to the Excise Act be made to provide for the issuance of a special temporary licence to persons who wish to engage in the manufacture of denatured spirits for use solely in experimentation and development of a fuel, where the denatured spirits and fuel are for the persons own use and not for sale or distribution. These amendments will not come into force until the necessary legislation has been enacted. In the meantime, appropriate rules and regulations are being developed and input from interested organizations and individuals is sought.

10861 (BEI—1980, pp 5) **Alcohol fuels in Saskatchewan.** Hutchinson, J. (Saskatchewan Dept. of Mineral Resources). 1980. CANMET/TID, Energy, Mines and Resources Canada, 5556 Booth St., Ottawa, Ont., Canada. (CONF-8006185—; CE—02121).

From Canadian national power alcohol conference; Winnipeg, Canada (20 Jun 1980).

The subject of alcohol fuels in Saskatchewan is addressed, in terms of energy policy, agricultural implications, and technology requirements. The paper concentrates on the option of immediate concern to the province, the production of ethanol from grain. The discussion takes into account the future energy situation, foreseen to be one of rising oil prices, supply disruption, and absence of inexpensive substitute oil sources or simple technical solutions. It also takes into account the influence of other energy options and the place of Saskatchewan in Canada's total energy system. Encouraging the production of ethanol from grain is seen to require some form of subsidization. However, provincial subsidization simply for energy supply reasons, it is concluded, would displace conventional liquid fuels (of which the province is already a net producer) to other areas of Canada, thus producing a national benefit at provincial cost. Subsidization could also be done for agricultural reasons, for example in order to establish a market for distressed grain, but sufficient reason to do so does not exist at this time. Production at the farm or community scale requires development of a more efficient and cost-effective technology, which is currently being promoted in the form of aid to fund renewable energy projects.

10862 (BEI—1980, pp 15) **Economic considerations of alcohol fuel substitution in Ontario road transportation.** Strang, D.K. (Canadian Resourcecon Ltd.). 1980. CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada. (CONF-8006185—; CE—02121).

From Canadian national power alcohol conference; Winnipeg, Canada (20 Jun 1980).

This paper presents some preliminary results of an economic study on commercial scale production of alcohol fuels in Ontario. Ethanol and methanol production costs are estimated, based on available technology and representative feedstock prices for production from wood, corn, or natural gas. On a gross energy basis, these costs will exceed conventional gasoline unless crude oil prices are in the $53-60/bbl range. A further complication to the economics of alcohol production is that the feedstock supply costs will increase if the oil price rises. Methanol costs will be lower than ethanol costs. Marketing these alcohols can be done in gasoline blends, in which case ethanol will be preferred because it is directly blendable and easier to market; or it can be done as straight fuels. In the latter case, vehicle modifications will be required and it is likely that marketing will be confined initially to fleet operations. A fuel substitution scenario is presented as a reference point for discussion, based on replacing ca 5% of conventional road transportation fuels with alcohol by 1995. In this scenario, ethanol-gasoline blends would have to capture ca 40% of the total gasoline market and straight methanol ca 25% of the urban fleet market; production would come from six corn-to-ethanol plants and three plants producing methanol from wood or natural gas. To encourage such a scenario, financial incentives would be required; depending on the assumptions chosen, total requirements would range from $200-900 million. The key impacts (employment, investment, feedstock requirements) for this scenario are outlined. 3 figs., 1 tab.

10863 **(PNL—6765-Vol.1) Effect of biomass feedstock chemical and physical properties on energy conversion processes: Volume 1, Overview.** Butner, R.S.; Elliott, D.C.; Sealock, L.J. Jr.; Pyne, J.W. (Pacific Northwest Lab., Richland, WA (USA)). Dec 1988. Contract AC06-76RL01830. 33p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005485/JAW.

Pacific Northwest Laboratory has completed an initial investigation of the effects of physical and chemical properties of biomass feedstocks relative to their performance in biomass energy conversion systems. Both biochemical conversion routes (anaerobic digestion and ethanol fermentation) and thermochemical routes (combustion, pyrolysis, and gasification) were included in the study. Related processes including chemical and physical pretreatment to improve digestibility, and size and density modification processes such as milling and pelletizing were also examined. This overview report provides background and discussion of feedstock and conversion relationships, along with recommendations for future research. The recommendations include (1) coordinate production and conversion research programs; (2) quantify the relationship between feedstock properties and conversion priorities; (3) develop a common framework for evaluating and characterizing biomass feedstocks; (4) include conversion effects as part of the criteria for selecting feedstock breeding programs; and (5) continue emphasis on multiple feedstock/conversion options for biomass energy systems. 9 refs., 3 figs., 2 tabs.

10864 **(PNL—6765-Vol.2) Effect of biomass feedstock chemical and physical properties on energy conversion processes: Volume 2, Appendices.** Butner, R.S.; Elliott, D.C.; Sealock, L.J., Jr.; Pyne, J.W. (Pacific Northwest Lab., Richland, WA (USA)). Dec 1988. Contract AC06-76RL01830. 97p. NTIS, PC A05/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005486/JAW.

This report presents an exploration of the relationships between biomass feedstocks and the conversion processes that utilize them. Specifically, it discusses the effect of the physical and chemical structure of biomass on conversion yields, rates, and efficiencies in a wide variety of available or experimental conversion processes. A greater understanding of the complex relationships between these conversion systems and the production of biomass for energy uses is required to help optimize the complex network of biomass production, collection, transportation, and conversion to useful energy products. The review of the literature confirmed the scarcity of research aimed specifically at identifying the effect of feedstock properties on conversion. In most cases, any mention of feedstock-related effects was limited to a few brief remarks (usually in qualitative terms) in the conclusions, or as a topic for further research. Attempts to determine the importance of feedstock parameters from published data were further hampered by the lack of consistent feedstock characterization and the difficulty of comparing results between different experimental systems. Further research will be required to establish quantitative relationships between feedstocks and performance criteria in conversion. 127 refs., 4 figs., 7 tabs.

10865 **(STU-I—580-1986) Alcohols and alcohol blends as motor fuels.** (Swedish National Board for Technical Development, Stockholm; International Energy Agency, 75 - Paris (France)). Oct 1986. 799p. Available only in Canada, Japan, New Zealand, Sweden and United States.

Contains three different parts, vol. 1, executive summary and vol. 2A and 2B.

The report has been prepared to convey information on established technologies with a minimum of technical details but with references to solid sources of information. Special emphasis has been given to emerging technologies that are advanced enough to permit appreciation for possible economic parity with other options. Commercial readiness for various options has been evaluated. The State-of-the-art report starts in chapter 1 with a background of the topic, that is, briefly, the current situation concerning conventional motor fuels production, distribution, and use. Chapters 2-8, which are based on technical facts available in the literature (governmental reports, conference proceedings, periodicals, etc.), are technical and non-specific with respect to country. Chapters 9 (on environment, health, and safety) and particularly 10 (on economic assessment) are summaries of earlier chapters with specific emphasis on environment and economy, respectively. Chapters 11-14 cover analyses, evaluations, and assessments.

0904 Solid Waste And Wood Fuels

REFER ALSO TO CITATION(S) 10905, 10910, 10965, 11237, 11289, 11293

10866 **(SC—8110) Cost benefit analysis of systems using flue gas or steam for drying of wood waste feedstocks.** MacCallum, C.; Blackwell, B.R.; Toresein, L. (Sandwell and Co. Ltd., Vancouver, British Columbia (Canada)). 1981. 204p. (CE—02200). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

This report presents the results of a study of drying systems for wood waste feedstocks, and includes descriptions of the various types of dryers (rotary, cascade, and flash dryers using flue gas, and indirect shell-and-tube and hot-air dryers using steam), discussions relating to the potential for drying wood waste feedstocks, and the operating problems which may be encountered. A cost benefit analysis was prepared on the basis of capital and operating cost estimates for retrofit dryer applications and for new boiler and dryer installations. It was found that except under certain circumstances, no significant savings can be expected from adding a dryer to a new modern boiler specifically designed to burn hog fuel of up to 60% moisture content. However, the benefits of drying hog fuel for older, less efficient installations are sufficiently high to warrant serious consideration of retrofit dryer installation. Sensitivity analysis reveals that the rates of return depend almost entirely on the price of fuel oil and are not particularly affected by the cost of electric power or hog fuel. Benefits of hog fuel drying include increased boiler efficiency, more efficient combustion with associated decrease in fly ash emissions, less need for auxiliary fuel, and easier boiler operation. The most significant benefit is the increased boiler steam-generating capacity. The additional power consumed by the dryer is expected to be <2% of the additional heat output of a retrofitted boiler. Good design minimizes operating problems associated with flue gas dryers; indirect steam dryers are also potentially beneficial, but more operational experience is needed. 44 refs., 57 figs., 30 tabs.

10867 **(SNV—3438) Dioxine measurements in small scale wood combustion.** Aakesson, E. (Statens Provningsanstalt, Stockholm (Sweden)). (National Swedish Environmental Protection Board, Solna). Feb 1988. 38p. (In Swedish). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755863/JAW.

Emission of dioxins when using wood as fuel in domestic boilers has been investigated. Two boilers with different types of combustion at three different types of operation have been tested. Determination of tar emission has also been done. One boiler has been a conventional boiler with overfiring, and with a water cooled fire chamber. The other has been a boiler with ceramic lining and under-firing. The different types of operation has been normal operation, operation with secondary air inlet closed and normal operation but with wood with high moisture content. The amounts of dioxins in the flue gases are low (5-50 pg/m/sup 3/ norm dry gas). Somewhat surprising is that operation with secondary air inlet closed gave lower dioxin emissions. The conventional boiler gave higher dioxin emissions than the boiler with ceramic lining.

10868 **(STEV-FBT—88-24) Smelting temperatures of straw ashes with and without additives. Laboratory tests and computer analyses.** Ivarsson, E.; Nilsson, C. (Swedish Univ. of Agricultural Sciences, Lund. Dept. of Farm Buildings). (Statens Energiverk, Stockholm (Sweden); Swedish Univ. of Agricultural Sciences, Lund. Dept. of Farm Buildings). 1988. 94p. (In Swedish). (SLU-LBT-S—153). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88755877/JAW.

The aim of the investigation presented in this report was to try to establish the factors that have the greatest and most determining influence on the softening and smelting temperatures of the straw ashes. 54 straw samples of winter rape, winter wheat and barley were analyzed and the combustion values and the composition of the straw were determined. Also the straw ashes from the different samples were analyzed referring to the composition and the smelting temperatures. Some results: * The mean gross calorific values of rape, wheat and barley were 18.2, 18.5 and 18.5 MJ/kg dry matter (d.m.) respectively. * The ash contents varied much between the samples. As a mean the ash content of the rape straw was 9.6% of the d.m. of the wheat straw 6.9% of the d.m. and that of the barley straw 6.7% of the d.m. * The mean ash softening temperatures were 1240, 920 and 900 degrees C for rape, wheat and barley straw ashes respectively. No linear correlations between the contents of certain substances of the straw and the smelting temperatures could be found. In this method several measuring variables were analysed simultaneously. Two such statistical methods were used, PCA (Principal Component Analysis) and PLS (Partial Least Squares in Latent Variables). The smelting process could satisfactorily be described for wheat from its chemical composition. A positive correlation was found referring to the silicon and the ash contents and a negative correlation was found referring to the potassium and the magnesium contents. In a final laboratory test dolomite, kaolin (china clay) and waste-lime from a beet sugar factory were added to the straw ashes in order to try to raise the smelting temperatures. The concentrations were 2, 4 and 6% (by weight). For all samples except when waste-lime was added to barley the smelting temperatures were raised. The softening temperature was raised more than 500 degrees C when kaolin was added to the barley straw. (authors).

10869 **(STEV-FBT—88-25) Less ash sinter by using kaolin additive in straw combustion.** Kristensen, D. (Swedish Univ. of Agricultural Sciences, Lund. Dept. of Farm Buildings). (Statens Energiverk, Stockholm (Sweden); Swedish Univ. of Agricultural Sciences, Lund. Dept. of Farm Buildings). 1988. 46p. (In Swedish). (SLU-LBT—154). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755878/JAW.

One way to solve the problem with ashsinter is to use additive with special properties. Laboratory investigation made it clear that when kaolin additive was used in straw combustion of wheat the melting temperature of the ashes increased considerably. The purpose of the fullscale experiment was to determine which quantity is needed in the combustion-zone so that the ash melting temperature will become higher than the combustion temperature in the furnace and also to verify the laboratory results. The method of the experiment was as follows: Two series of experimental combustion when straw of wheat was used were carried out and where the amount of kaolin additive varied between 0 and 8 percent by weight dry matter of the straw. The result of the experiment verified that by combustion of pellets with additive between 4 and 8 percent kaolin by weight the ash sinter could almost be eliminated, but by combustion of straw bales with the same amount of kaolin, some ashes had sintered anyway. This was presumably due to the fact that the ratio between the amount of straw and kaolin was not always the intended in the combustion zone.

10870 **(STEV-FBT—88-26) Flue gas condensation plant. Report on results of operation and purification.** (Statens Energiverk, Stockholm (Sweden)). May 1988. 289p. (In Swedish). NTIS (US Sales Only), PC A13/MF A01. Order Number DE88755879/JAW.

The plant was erected in 1985/1986 in order to decrease emissions of mercury and hydrogen chloride from the waste com-

bustion plant, thus attaining environmental improvement. At the same time the plant produces 150 GWh energy yearly by the lowering of the flue gas temperature to 35 degrees C. Energy is supplied to the district heating system through two absorption heat pumps raising the temperature to 75 degrees C. The plant was not running until April 1987 because of operation trouble caused by faulty design of the reheater following the flue gas condensation. Availability of the whole plant was beside revision 75%, and 95% excluding the reheater. The separation efficiency of mercury and hydrogen chlorides was respectively >80% and >95% at nominal load operation. The plant will comply with the so called ENA-requirements for hydrogen chloride, dust and mercury (ENA = the refuse report of the National Energy Administration and the National Swedish Environment Protection Board) For dioxins the separation efficiency is only c. 40%. Despite of this low degree of separation the exhaust gas value has been lowered to the 0.5-2ng/m/ sup 3/ ENA-requirement through improvements of of the incinerators. (O.S.).

10871 **(WSL-LR—643(MR)) Laboratory characterisation of refuse derived fuel.** Rampling, T.W.; Hickey, T.J. (Warren Spring Lab., Stevenage (UK); UKAEA Harwell Lab. Energy Technology Div.). 1988. 187p. (ETSU-B—1161). British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks, LS23 7BQ.

A report is presented on laboratory characterization of refuse-derived-fuel (RDF) carried out at Warren Springs Laboratory in the UK. The principle activities were a literature survey of the characteristics and combustion of RDF, a technical visit to the USA to several establishments engaged in similar research and a series of tests both at bench and larger scale. These tests included the evolution of volatiles during thermal degradation, thermal analysis, microscopic examination of the structure of RDF and coal chars, the combustion of RDF and coal char and chemical and X-ray diffraction studies. (U.K.).

0905 Liquid Waste Fuels

REFER ALSO TO CITATION(S) 10844

13 HYDRO ENERGY

REFER ALSO TO CITATION(S) 11171

1301 Resources And Availability

10872 **(AD-A—198748/6/XAB) Multi-purpose, multi-reservoir simulation on a PC. Technical paper.** Eichert, B.S.; Franke, C. (Hydrologic Engineering Center, Davis, CA (USA)). Aug 1988. 22p. (HEC-TP—119). NTIS, PC A03/ MF A01.

The methodology and difficulties in converting a large, general-purpose, mainframe, batch-oriented computer program (for reservoir simulation) to work effectively in the PC environment are described in this paper. A brief overview of the present capabilities of the general purpose reservoir simulation program (HEC-5), which works on mainframe and MS DOS compatible computers, is also presented.

10873 **(E/WSC—1987) Historical streamflow summary. Atlantic provinces to, 1986.** (Environment Canada, Ottawa, Ontario. Water Survey of Canada). 1987. 285p. (In English and French). (MICROLOG—88-01753). Environment Canada, Document, Text and Library Services, Terrasses de la Chaudiere, 10 Wellington St., Ottawa, Ont., Canada K1A 0H3; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

A summary is presented of monthly and annual mean discharges, and annual extremes of discharge, for rivers in Newfoundland and Labrador, New Brunswick, Nova Scotia, and Prince Edward Island for which streamflow data to 1986 inclusive have been collected. Data are presented for the entire period of record, as far back as 1915 in Nova Scotia, when hydrometric investigations were conducted by the Dominion Water Power Branch in cooperation with the Nova Scotia Water Power Commission. Later on, survey operations were conducted in these Atlantic provinces by the federal government. Current survey data are collected in cooperation with the provincial governments, assisted by other public agencies and private organizations concerned with water resources. This document also contains descriptive information about gauging stations, such as location, drainage area, and whether the flow is natural or regulated. Data are arranged alphabetically by name of gauging station within each province.

10874 **(E/WSC—1987) Historical streamflow summary, Manitoba, to 1986.** (Environment Canada, Ottawa, Ontario. Water Survey of Canada). 1987. 280p. (In English and French). (MICROLOG—88-01617). Environment Canada, Document, Text and Library Services, Terrasses de la Chaudiere, 10 Wellington St., Ottawa, Ont., Canada K1A 0H3; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

A summary is presented of monthly and annual mean discharges, and annual extremes of discharge, for rivers in Manitoba for which streamflow data to 1986 inclusive have been collected. Data are presented for the entire period of record, as far back as 1911, when the Winnipeg River Power survey was commenced by the Dominion Water Power Branch. Later survey work was conducted by the Manitoba Hydrographic Survey and by the federal government. Current survey data are collected in cooperation with the provincial government, assisted by other public agencies and private organizations concerned with water resources. This document also contains descriptive information about gauging stations, such as location, drainage area, and whether the flow is natural or regulated. Data are arranged alphabetically by name of gauging station.

10875 **(E/WSC—1987) Historical streamflow summary, Saskatchewan, to 1986.** (Environment Canada, Ottawa, Ontario. Water Survey of Canada). 1987. 421p. (In English and French). (MICROLOG—88-02308). Environment Canada, Document, Text and Library Services, Terrasses de la Chaudiere, 10 Wellington St., Ottawa, Ont., Canada K1A 0H3; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

A summary is presented of monthly and annual mean discharges, and annual extremes of discharge, for rivers in Saskatchewan for which streamflow data to 1986 inclusive have been collected. Data are presented for the entire period of record, as far back as the late 1800s, when stream measurement work was carried out in connection with irrigation surveys. In 1920 hydrometric surveys were transferred to the federal Dominion Water Power Branch, and survey work continued to be done by the federal government. Current survey data are collected in cooperation with the provincial government, assisted by other public agencies and private organizations concerned with water resources. This document also contains descriptive information about gauging stations, such as location, drainage area, and whether the flow is natural or regulated. Data are arranged alphabetically by name of gauging station.

10876 **(E/WSC—1987) Historical streamflow summary, Ontario, to 1986.** (Environment Canada, Ottawa, Ontario. Water Survey of Canada). 1987. 797p. (In English and French). (MICROLOG—88-02438). Environment Canada, Document, Text and Library Services, Terrasses de la Chaudiere, 10 Wellington St., Ottawa, Ont., Canada K1A 0H3; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

A summary is presented of monthly and annual mean discharges, and annual extremes of discharge, for rivers in Ontario for which streamflow data to 1986 inclusive have been collected. Data are presented for the entire period of record, as far back as 1912, when hydrometric survey operations were carried out by the Hydro-Electric Power Commission of Ontario. Current survey data are collected by the Water Survey of Canada in cooperation with

Ontario Hydro and the provincial natural resources and environment ministries, and assisted by other public agencies and private organizations concerned with water resources. This document also contains descriptive information about gauging stations, such as location, drainage area, and whether the flow is natural or regulated. Data are arranged alphabetically by name of gauging station.

10877 **(E/WSC—1987) Historical streamflow summary, Alberta, to 1986.** (Environment Canada, Ottawa, Ontario. Water Survey of Canada). 1987. 582p. (In English and French). (MICROLOG—88-02243). Environment Canada, Document, Text and Library Services, Terrasses de la Chaudiere, 10 Wellington St., Ottawa, Ont., Canada K1A 0H3; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

A summary is presented of monthly and annual mean discharges, and annual extremes of discharge, for rivers in Alberta for which streamflow data to 1986 inclusive have been collected. Data are presented for the entire period of record, as far back as the late 1800s, when stream measurement work was connected with irrigation surveys. Current survey data are collected by the Water Survey of Canada in cooperation with the provincial government, and assisted by other public agencies and private organizations concerned with water resources, such as electric utilities. This document also contains descriptive information about gauging stations, such as location, drainage area, and whether the flow is natural or regulated. Data are arranged alphabetically by name of gauging station.

1302 Site Geology And Meteorology

REFER ALSO TO CITATION(S) 10878

1303 Plant Design And Operation

10878 **(DOE/ID/12125—2) Small-scale hydroelectric power demonstration project: Broad River Electric Cooperative, Inc., Cherokee Falls, South Carolina: Final operations and maintenance report.** (Broad River Electric Cooperative, Inc., Cherokee Falls, SC (USA)). Aug 1988. Contract FC07-80ID12125. 44p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89004766/JAW.

The purpose of this report is to give a final accounting of the costs and benefits derived from the first two years of operation of the Cherokee Falls, Broad River Hydroelectric Demonstration Project which was built at Cherokee Falls, South Carolina. Prior to construction, Broad River Electric Cooperative, Inc. (BREC) executed a Cooperative Agreement with the US Department of Energy (DOE) Number FC07-80ID12125 which provided $1,052,664 toward the construction of the facility. This agreement requires that BREC document for DOE a summary of the complete operating statistics, operating and maintenance cost, and revenues from power sales for a two-year operating period. A complete reporting covering the design, technical, construction, legal, institutional, environmental and other related aspects of the total project was furnished to DOE previously for publication as the "Final Technical and Construction Cost Report". For this reason these elements will not be addressed in detail in this report. In order to make this account a more meaningful discussion of the initial two-year and four month production period, it is necessary to detail several unique events concerning the project which set Cherokee Falls apart from other projects developed under similar Cooperative Agreements with DOE. Accordingly, this report will discuss certain major problems experienced with the design, operation and maintenance, energy production, as well as the operation and maintenance cost and value of the power produced for the first 28 months of operation. 3 figs.

10879 **(EFI-TR—3371) Run orientated description for the use of the computer programs VANSIMTAP og SAMKJOERINGSMODELLEN.** Hirsch, R. von. (Elektrisitetsforsyningens Forskningsinstitutt, Trondheim (Norway)). Nov 1986. 40p. (In Norwegian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755751/JAW.

The report embodies a run-oriented description on the use of the computer programs VANSIMTAP and SAMKJOERINGSMODELLEN. VANSIMTAP is a program designed for the operation- and development planning in watercourses with arbitrary serial-parallel structures. SAMKJOERINGSMODELLEN is a program to be used for the operation- and development planning in hydroelectric power systems. Following items are commentated: (1) Model planning (2) Calibration of models (3) Evaluation/simulation of water equipment (4) Presentation of results. 11 figures, 12 tables.

1305 Economics And Management

REFER ALSO TO CITATION(S) 11168

1306 Environmental Aspects

REFER ALSO TO CITATION(S) 11168, 11169

10880 (ACUNS—88, pp 275-280) **Some implications of hydroelectric development and related engineering projects in northern Canada.** Chapman, A.R. (Trent Univ., Peterborough, Ont.). 1988. Association of Canadian Universities for Northern Studies, 130 Albert Street, Ottawa, Ont., Canada K1P 5G4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN. (CONF-8511343—; MICROLOG—88-02606).

From National student conference on northern studies; Ottawa, Canada (18 Nov 1985).

While economic gains associated with the damming and diversion of northern Canadian rivers have generally benefited Canada as a whole, there are many consequences detrimental to northen environments and people. This paper briefly surveys the major river engineering projects that have been completed in or planned for, the Canadian north, and describes some of the associated ecological and social effects. Completed in 1976, the Southern Indian Lake impoundment and Churchill River diversion project diverts 75% of the Churchill River southwards across the natural drainage divide, along 300 km of tributary valleys , and into the Nelson river channel, where a 10,000 MW hydroelectric scheme is being developed. Environmental changes associated with the project include: severe errosion of glacial shorelines, which previously existed in permafrost; reduced light penetration in flooded lakes; collapse of the whitefish fishery in southern Indian Lake; and increases in fish mercury levels in flooded lakes. Many of the major environmental effects of flooding and diversion where either poorly predicted or completely unpredicted, despite extensive pre-development studies. Associated with the environmental effects were severe socio-economic repercussions for communities along the diversion route. The GRAND Canal Concept would turn James Bay into a freshwater lake and divert the water southward. This project, the largest yet proposed for any northern country, has the potential for unpredictable environmental disruption of an unprecedented magnitude. Immediately affected would be 10,000 Inuit living along James Bay, and another 22,000 treaty Indians in Northern Ontario. 22 refs., 3 figs.

1307 Power-conversion Systems

REFER ALSO TO CITATION(S) 10878

10881 **(NEI-FI—50) Chances and economy for using a small thermogenerator. Preliminary study.** Insinoeoeritoimisto Rejlers Oy. (Kauppa-ja Teollisuusministerio, Helsinki (Finland). Energiaosasto). 1988. 44p. (In Finnish). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755811/JAW.

Small waterfalls and windenergy can be considered as suitable energy sources for direct mechanic heat generation in Finland. The capacity of small waterfalls is estimated at 505 MW, of which 15 MW can be used for heat generation to compensate heating by oil and electricity. The kinetic energy values per rotating area of windturbine calculated by using annual mean values of wind veloci-

ty are 500-2000 kWh/m/sup 2/,a on the coast and in the isles where the use of windenergy can be economic. The methods used for direct heat generation are based on utilization of friction heat of liquids in mechanical or hydraulic equipment. In hydraulic thermogenerator thermal oil is pumped through isentalpic orifices and pressure energy changes to the heat of oil. In kinetic thermogenerator rotating rotor and standing stator are blocked in a chamber full of thermal oil heated with friction heat due to moving rotor. Waterbrake works either like kinetic thermogenerator with water instead of oil, or so that a shaft rotates a brakeshoe which rubs inner surface of water tank. In Finland the best direct heating method is kinetic thermogenerator (20 KW). If there is old wind or water mill, the generator heat is cheaper than electric or oil heat when generated heat is more than 20 MHw/a. If new wind mill is built, generated heat must be more than 70 MWh/a to make heat generation profitable. It is never profitable to build a new water mill for heat generator.

14 SOLAR ENERGY

REFER ALSO TO CITATION(S) 11192

1403 Economics

10882 **(MA—PV-1) Near-term markets for photovoltaic power systems in Canada.** Haas, L.J.M. (Middleton Associates, Toronto, Ontario (Canada)). 1980. 332p. (CE—02193). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

The specific objective of this study was to characterize near-term markets (1979-1984) for photovoltaic devices in Canada, through the identification and evaluation of those applications most likely to contribute to early market growth. It was found that a hierarchy of priorities based on cost-effectiveness can be identified in which small, remote-stand-alone systems rank the highest. In the longer term larger power demand devices and grid-connected applications competing with conventional power sources hold the promise of substantially larger and diverse markets. As cell costs, balance-of-systems cost and engineering costs decline, the competitive threshold will move progressively downward, revealing incremental markets in some instances and major new applications in others. For this study, the markets were segmented into several categories, namely, communications equipment, marking and warning devices, monitoring and sensing equipment, corrosion protection, lighting and general power sources, consumer products and miscellaneous exports. Based on certain assumptions of technical feasibility and cost-effectiveness, the total cumulative potential market for these applications, excluding export, over 1979-1984 is estimated at up to 2.4 MW. Though these initial markets are small and fragmentary, they will be sufficient, if fully exploited, to support a number of initiatives by Canadian solar companies. The nature, extent and effectiveness of government policy with respect to encouragement of photovoltaic industrial market and developmentare obvious factors that will affect the rate of penetration into remote power supply markets. 76 refs., 11 figs., 53 tabs.

10883 **(NRC—7911) CAISSE (Computer Aided Information System on Solar Energy) technical manual.** Cantelon, P.E.; Beinhauer, F.W. (National Research Council of Canada, Ottawa, Ontario). 1979. 77p. (In English and French). (CE—02187). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

The Computer Aided Information System on Solar Energy (CAISSE) was developed to provide the general public with information on solar energy and its potential uses and costs for domestic consumption. CAISSE is an interactive computing system which illustrates solar heating concepts through the use of 35 mm slides, text displays on a screen and a printed report. The user communicates with the computer by responding to questions about his home and heating requirements through a touch sensitive screen. The CAISSE system contains a solar heating simulation model which calculates the heating load capable of being supplied by a solar heating system and uses this information to illustrate installation costs, fuel savings and a 20 year life-cycle analysis of cost and benefits. The system contains several sets of radiation and weather data for Canada and USA. The selection of one of four collector models is based upon the requirements input during the computer session. Optimistic and pessimistic fuel cost forecasts are made for oil, natural gas, electricity, or propane; and the forecasted fuel cost is made the basis of the life cycle cost evaluation for the solar heating application chosen. This manual is organized so that each section describes one major aspect of the use of solar energy systems to provide energy for domestic consumption. The sources of data and technical information and the method of incorporating them into the CAISSE display system are described in the same order as the computer processing. Each section concludes with a list of future developments that could be included to make CAISSE outputs more regionally specific and more useful to designers. 19 refs., 1 tab.

1405 Solar Energy Conversion

REFER ALSO TO CITATION(S) 10842, 10843, 10844, 10852, 10854, 10858, 10859, 10866, 10871, 10965, 11707, 11948

10884 **(AFME—85-09-1106-1) Research report: AFME-AIT biomass project.** Bhattacharya, S.C.; Shah, N.; Somjedh, R. (Agence Francaise pour la Maitrise de l'Energie, 75 - Paris). 1986. 26p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756323/JAW.

The work under this project component in the framework of AFME-AIT collaboration was done with relatively small budget and thus the scope was limited to few activities. The activities in this sub-program included following components: (1) Industrial wood-energy audits and conservation possibilities for selected Thai industries. (2) Design, construction, and testing of a direct heat gasifier for drying maize. (3) Development and setting up of testing facilities for biomass gasifiers at Energy Research Park of AIT. Preliminary work dealing with identification of major wood using industries in Thailand and collection of some data from a few such industries was completed. Further detailed energy-audit work was restricted because of the non-availability of continued funding. A down-draft gasifier without any constriction (throat) was coupled to a gas burner designed and built - at AIT. The ejector system used in this study has been found to be satisfactory and avoids the necessity of an additional blowet for starting up of a forced draft gasifier. The testing suggests that such a system could be feasible in a field to provide direct heat for drying shelled corn. Further developmental work is being continued in the framework of other program. A small laboratory has been set-up at the Energy Research Park of AIT to evaluate the performance of biomass gasifiers.

10885 **(BCR—8110) Supercritical gas extraction of chemicals from forest products. Phase 2.** McDonald, E.C.; Howard, J. (B.C. Research, Vancouver (Canada)). 1981. 82p. (CE—02197). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

Liquid products containing over 90% of the carbon content of wood were isolated following extracton of green sawdusts using supercritical methanol and supercritical acetone. Methanol at 360/sup 0/C or acetone at 300/sup 0/C and 27.6 megapascals gave weight yields in excess of 70%, based upon dry western red cedar wood, of dark viscous products. Pretreatment of the wood with strong acid gave similar yields at lower extraction temperatures and pressures. The effect of temperature, pressure, extraction time, flow rate, solvent and wood species on product yield were also examined. Analysis of the products to determine the main components was attempted, but separation of the complex mixtures into clean fractions was not achieved. Levoglucosan has been tentatively identified as a component of the extracts. Elemental analysis indicated the extracts contained about 60% carbon, 6% hydrogen and 30% oxygen. The calorific values of the extracts were generally between 24,000 kJ/kg and 26,000 kJ/kg. An economic analysis based on laboratory experiments indicated that product cost could be $21/bbl for a 2,400 bbl/d plant, excluding land and wood costs. 11 refs., 11 figs., 10 tabs.

10886 (BEI—1980, pp 12) **Agricultural resources for ethanol production.** Hayes, R.D. (Agriculture Canada, Ottawa, Ont.). 1980. CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada. (CONF-8006185—; CE—02121).

From Canadian national power alcohol conference; Winnipeg, Canada (20 Jun 1980).

Fermentation of the total Canadian production of sugar and starch crops could theoretically yield 14.6 billion litres of fuel ethanol or about 27% of projected 1990 gasoline demand. There are many reasons besides moral concerns of diverting food from the food system to fuel production that will limit much of this from ever going into ethanol production. Undoubtedly, in special situations, some high value food and feed crops could economically find their way into fuel markets. Assuming management constraints in handling certain vegetable crops are overcome, much of Canada's cull produce that is not destined for animal feed could be utilized as fermentation feedstock. Special energy crops, because of their very high yield per hectare of land base, might be grown economically for ethanol production assuming both energy and crop prices are favourable to this end-use. Food processing effluents, particularly from potato processors and cheese manufacturers offer potential as ethanol feedstocks due to their low cost and normally associated environmental hazards. Crop residues in site specific locations would appear to offer the major contribution to an alcohol fuels program for the future, assuming low cost technology for their conversion can be made commercially available. Besides the many current constraints to their full utilization, there are other opportunities for using these feedstocks such as fibre, animal feed, and alternative fermentations. Although the 500-900 million litres of ethanol that could be produced from agriculturally based feedstocks by the early 1990s represents a small contribution to Canada's goal of self-sufficiency in liquid fuels on a national scale, it would provide significant regional energy, environmental, and industrial impacts. 4 refs., 4 tabs.

10887 (BEI—1980, pp 8) **Status of Alberta's Forest Biomass to Energy Program.** Karaim, B.W. (Alberta Dept. of Energy and Natural Resources). 1980. CANMET/TID, Energy, Mines and Resources Canada, 555 booth St., Ottawa, Ont., Canada. (CONF-8006185—; CE—02121).

From Canadian national power alcohol conference; Winnipeg, Canada (20 Jun 1980).

In spite of Alberta's position as Canada's leading energy producer from nonrenewable sources, the province has established a program to investigate alternative energy options from wood and mill residues. It has been found that wood waste resources are considerable, and show potential as a source for both energy and chemicals. However, large scale plants based solely on surplus aspen poplar are not economic. Gasification of wood waste to provide fuel, or synthesis gas for production of chemicals (such as methanol), is a promising technology that still needs further development. A specific research program in this area was proposed: evaluation of wood gasification for use in Alberta's sawmill industry. Preliminary results showed gasification of sawmill wastes had no economic advantage over direct combustion; however, the suggestion was made to apply wood gasification to fuelling gas turbines at remotely-located compressor stations.

10888 (BEI—1980, pp 8) **Present state of research and development in biomass energy production in Quebec.** Chamberland, A. (IREQ Institut de recherche de l'Hydro-Quebec). 1980. CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada. (CONF-8006185—; CE—02121).

From Canadian national power alcohol conference; Winnipeg, Canada (20 Jun 1980).

Biomass sources for energy production in Quebec at the present time are peat and wood wastes. This paper outlines some research programs investigating these energy sources and their possibilities for integration into Quebec's energy matrix. These programs include synthesis of hydrocarbons and alcohols from biomass, construction of a diesel generating plant to run on gasified peat, and methanol production from wood. 1 fig., 3 tabs.

10889 (BR—88(42)) **Reestablishment of bottomland hardwood forests on disturbed sites: An annotated bibliography.** Haynes, R.J.; Allen, J.A.; Pendleton, E.C. (Fish and Wildlife Service, Washington, DC (USA)). Sep 1988. 105p. OSTI - US Fish and Wildlife Service, 1010 Gause Blvd., Slidell, LA 70458. Order Number TI89004350/JAW.

This bibliography was prepared to assist environmental planners, managers, and others who are interested in reestablishing bottomland hardwood forests on disturbed sites. Emphasis is on the Southeastern United States. There are 111 annotated entries; 259 non-annotated entries; and two appendixes--(A) common and scientific names and (B) flooding and shade tolerances and reproductive characteristics of common bottomland hardwood forest species. Cross-referencing is by species and subject.

10890 (CONF-8809158—1) **Biotechnology and poplars: A US perspective.** Layton, P.; Ostry, M.E. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 16p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89003935/JAW.

From Willow breeding/biotechnology development joint workshop; Bristol, UK (30 Sep 1988).

An increasing number of researchers are investigating Populus spp. using biotechnical research techniques. Its commercial importance, genome size, and relative ease of propagation from cell and tissue culture are contributing to the increase. Significant progress has been made in refining cell and tissue culture methods and identifying the associated genetic variability. Researchers have identified somaclones with acceptable tolerance levels to several herbicides and diseases. Genetic transformation of poplars has progressed with the development of several gene transfer methods (Agrobacterium, electroporation, and microprojectiles) and the incorporation of commercially important genes (aroA and potato inhibitor II). Research on gene promoters has progressed, and two putative wound inducible promoters have been identified in hybrid poplar. Although federal research dollars in FY 1989 are low for forest biotechnology, research is continuing. Federal research dollars may rise again in 1990 to aid the exploitation of biotechnology to enhance poplar growth and production, especially for use as energy feedstocks. 13 refs., 1 fig.

10891 (DOE/CE/15270—T8) **Explorations of mechanisms regulating ectomycorrhizal colonization of boron-fertilized pine: Quarterly report, 1 October 1988--31 December 1988.** Garrett, H.E.; Begonia, G.; Reid, R.K.; Sword, M.A. (Missouri Univ., Columbia (USA). School of Forestry, Fisheries and Wildlife). 1988. Contract FG01-86CE15270. 4p. NTIS, PC A02/MF A01 - OSTI. Order Number TI89004676/JAW.

This project evaluates the effects of various compounds on the success of fungal infections in plant roots. Research efforts are intended: to evaluate the effectiveness of phenolase in metabolizing the most and least toxic phenolic compounds studied; to determine the types and quantities of phenolic compounds produced by pine seedlings inoculated with {ital Pisolithus tinctorius} and receiving boron fertilization; to determine the effects of hydroxylation of phenolic compounds on the growth of {ital Pisolithus tinctorius}, a known ectomycorrhizal fungus, grown in pure culture; and to determine the effect of phenolic glycosides on the growth of {ital Pisolithus tinctorius}, grown in pure culture.

10892 (ETSU-B—1166-pt.1) **Energy forestry in Britain: environmental issues. Final report V.1. Principal findings.** (UKAEA Harwell Lab. Energy Technology Div.; Environmental Resources Ltd., London (UK)). Jul 1987. 73p. British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ.

UK study described was undertaken to identify and assess the environmental effects of energy forestry and their impacts and benefits; to identify ways in which these impacts may constrain energy forestry development; to recommend areas for further research and possible mitigation measures; to provide information on the environmental effects of energy forestry to decision-makers, land users and others; and to obtain their views on the possible environmental impacts.

10893 **(ETSU-B—1166-pt.2) Energy forestry in Britain: environmental issues. Final report. V.2. Technical annexes.** (UKAEA Harwell Lab. Energy Technology Div.; Environmental Resources Ltd., London (UK)). Jul 1987. 295p. British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ.

A UK study of the environmental effects of energy forestry is described. The main aims of the study were to identify and assess the environmental effects of energy forestry and their impacts and benefits; to identify ways in which these impacts may constrain energy forestry development; to recommend possible mitigation measures and areas for further research; to provide information on the environmental impacts of energy forestry to decision-makers, land users and others; and to obtain their views on the possible environmental impacts.

10894 **(N—89-11315) PV modules for ground testing. Final report.** (Lockheed Missiles and Space Co., Sunnyvale, CA (USA)). Sep 1986. 132p. (NASA-CR—179476; NAS—1.26:179476; LMSC/D—973480). NTIS, PC A07/MF A01.

The main objective was to design and build a minimum of three photovoltaic test panels for plasma interaction experiments. These experiments are intended to provide data on the interactions between high-voltage solar arrays and the space plasma environment. Data gathered will significantly contribute to the development of design criteria for the space station solar arrays. Electrical isolation between the solar cell strings and the module mounting plate is required for high-voltage bias.

10895 **(NEI-SE—28) Perspectives for the technical application of alternative grown lignocellulosics.** Mitchell, C.P.; Sennerby-Forsse, L.; Zsuffa, L. (Univ. of Aberdeen (GB). Dept. of Forestry; Swedish Univ. of Agricultural Sci., Uppsala (SE). Energy Forestry Project; Univ. of Toronto (CA). Faculty of Forestry). (European Federation of Biotechnology, Frankfurt am Main (Germany, F.R.)). 1986. 19p. (CONF-8606421—1). NTIS (US Sales Only), PC A03. Order Number DE88755831/JAW.

From 2. workshop on agricultural surpluses: elaboration of a problem-oriented strategic decision-matrix for research projects in agriculture; Stockholm, Sweden (14 Jun 1986).

Production systems for growing woody lignocellulosic materials on short rotation on agricultural land are briefly described. Potential uses for this biomass are outlined and related to the characteristics of the harvested material. The role of genetics and silvicultural manipulations in generating new and more appropriate feedstocks is discussed. Recommendations for necessary R and D to develop the potential for short rotation production systems for lignocellulosics are given. (authors).

10896 **(NP—9770180) Studies on anaerobic degradation of propionate in syntrophic cocultures of acetogenic, sulfidogenic and methanogenic bacteria.** Mucha, H. (Hohenheim Univ., Stuttgart (Germany, F.R.). Fakultaet 2 - Biologie). 1987. 92p. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE89770180/JAW.

The propionate degradation in methanogenic systems was studied as a contribution to the optimization of biogas production. The thermodynamically unfavourable reaction course of propionate degradation is a determining parameter of the process of methane fermentation. The accumulation of propionic acid in substrates restrains methanogenesis. The methylmalonyl-CoA path is proposed as a metabolic model of the anaerobic degradation of propionate to acetate. The metabolic effects of acetogenic, sulfidogenic and methanogenic bacteria in propionate degradation were studied with the syntrophic model cultures syntrophobacter wolinii/desulfovibrio G11 and syntrophobacter wolinii/desulfovibrio G11/M. barkeri. The results obtained were compared with the metabolism model proposed. For this purpose, the growth of the model cultures was first optimized. Very high propionate degradation rates were determined for all model cultures, the pH value being 7.2. During the fumigation of S. wolinii/D. G11 with hydrogen or inert gas, degradation rates of 50 and 35 mM/d were obtained. The co-culture S. wolinii/D. G11/M. barkeri attained a degradation rate of 71 mM/d during fumigation with argon.

10897 **(NP—9770190) Development of biotechnical processes for purification of liquid waste from coal processing. Final report.** Jockers, R.; Patalas, N.; Schacht, S.; Rehm, H.J.; Freier, D. (Bergbau-Forschung G.m.b.H. Forschungsinstitut des Steinkohlenbergbauvereins, Essen (Germany, F.R.). Abt. Entsorgungstechnik). Apr 1988. 158p. (In German). NTIS (US Sales Only), PC A08/MF A01. Order Number DE89770190/JAW.

Within the framework of the project special cultures of microorganisms were tested for their efficiency for the degradation of phenol-containing waste waters from coal upgrading plants. Furthermore, different immobilization methods and reactor types for the use of highly polluted waste waters were tested. A biotechnical process was developed which is expected to have excellent chances for practical realization on an industrial scale.

10898 **(ORNL—6514) Herbaceous energy crops program: Annual progress report for FY 1987.** Cushman, J.H.; Turhollow, A.F.; Johnston, J.W. (Oak Ridge National Lab., TN (USA)). Jan 1989. Contract AC05-84OR21400. 57p. NTIS, PC A04/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005705/JAW.

This report describes the activities and accomplishments of the Herbaceous Energy Crops Program (HECP) for the year ending September 30, 1987. The HECP is one of three research programs on the production of biomass energy crops supported by the US Department of Energy's Biofuels and Municipal Waste Technology Division. It is devoted to research on the development of terrestrial, nonwoody plant species for use as energy feedstocks. Oak Ridge National Laboratory provides field management for the HECP and has overall responsibility for its research. The HECP focuses on the types of crops that appear most promising for producing fuels or feedstocks for fuels. The research program emphasizes lignocellulosic energy crops as feedstocks for biochemical and thermochemical conversion to liquid and gaseous fuels. In FY 1987 screening and selection trials continued for a third year at five institutions in the Southeast and Midwest/Lake States, and two new projects were initiated in the Great Plains. 18 refs., 7 figs., 15 tabs.

10899 **(ORNL/M—606) The potential of biotechnology in the Biomass Production Program.** Ellis, D.D.; McCown, B.H. (Oak Ridge National Lab., TN (USA)). Oct 1988. Contract AC05-84OR21400. 67p. NTIS, PC A04/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005710/JAW.

This report surveys the application of biotechnology (including in vitro cloning and genetic engineering) in addressing some of the major problems encountered in growing and utilizing plants for energy production. The scope is restricted to the problems that occur in the production of the raw material (the growing of the plant) and not in the actual processing of the biomass (energy conversion). The focus is limited to the four herbaceous plants (sorghum, switchgrass, weeping lovegrass, and sericea lespedeza) and the seven woody plants (popular, black locust, sycamore, sweetgum, silver maple, alder and eucalyptus) that are currently targeted by the DOE Biomass Production Program. The first part of the report defines the problems with each species that are or may be approachable by biotechnology. The second part gives recommendations on the research emphases incorporating biotechnological approaches for three funding scenarios: (1) funding continued at the levels currently experienced by the Biomass Production Program, (2) earmarking $500,000 additional each year for biotechnology for three years, and (3) earmarking $500,000 additional each year for biotechnology for five years. 68 refs., 1 fig., 22 tabs.

10900 **(ORNL/Sub—84-18435/1) Productivity of wet soils: Biomass of cultivated and natural vegetation.** Johnston, C.A. (Oak Ridge National Lab., TN (USA); Johnston (Carol A.), Duluth, MN (USA)). Dec 1988. Contract AC05-84OR21400. 161p. NTIS, PC A08/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005711/JAW.

Wet soils, soils which have agronomic limitations because of excess water, comprise 105 million acres of non-federal land in the conterminous United States. Wet soils which support hydrophytic plants are "wetlands", and are some of the most productive natural ecosystems in the world. When both above- and belowground pro-

ductivity are considered, cattail (Typha latifolia) is the most productive temperate wetland species (26.4 Mg/ha/year). Both cattail and reed (Phragmites australis) have aboveground productivities of about 13 Mg/ha/year. Although average aboveground yields of reed canarygrass (Phalaris arundinacea) are lower (9.5 Mg/ha/year), techniques for its establishment and cultivation are well-developed. Other herbaceous wetland species which show promise as biomass crops include sedge (Carex spp.), river bulrush (Scirpus fluviatilis) and prairie cordgrass (Spartina pectinata). About 40% of wet soils in the conterminous US are currently cultivated, and they produce one-quarter of the major US crops. Most of this land is artificially drained for crops such as corn, soybeans, and vegetables. US wetlands are drained for agriculture at the rate of 223,000 ha/yr. Paddies flooded with water are used to grow rice, cranberries, and wild rice. Forage and live sphagnum moss are products of undrained wetlands. A number of federal and state regulations apply to the draining or irrigation of wetlands, but most do not seriously restrict their use for agriculture. 320 refs., 36 tabs.

10901 **(OY/PSTL—C82) Development of a tractor-mounted harvester for short-rotation fuelwood plantations.** Tervo, M.; Kiukaanniemi, E. (Oulu Univ. (Finland). Research Inst. of Northern Finland). 1987. 75p. (In Finnish). NTIS (US Sales Only), PC A04. Order Number DE88755840/JAW.

The aim of this study has been to develop a tractor-mounted feller-buncher for harvesting in short-rotation fuelwood plantations. The machine was planned and constructed by SAH-KO Co. on the basis of research results and ideas made available by the Research Institute of Northern Finland and Turveruukki Co. It cuts the trees in a given row and lifts them whole into the loading space behind the tractor. When the loading space is full the bundle is dropped onto the ground. The prototype can be developed further, and could be improved ready for commercial production with little additional effort, since the last trials showed it to function virtually faultlessly under good field conditions. The machine could be used at its present working level for harvesting trial plantations. Nomograms were also constructed for estimating the costs of harvesting and its efficiency, given values for the principal variables regarding the harvesting system.

10902 **(OY/PSTL-TIED—52) Ectomycorrhizal inoculation of willows on cut-over bored peatland.** Loree, M.; Lumme, I.; Niemi, M.; Toermaelae, T. (Oulu Univ. (Finland). Research Inst. of Northern Finland). May 1988. 26p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755841/JAW.

Ectomycorrhizal fungal inoculation was explored as a means to improve productivity of experimental short-rotation plantations of the willows Salix viminalis L. and Salix dasyclados Wimm. for biomass production on surface-mined peatlands in northern Finland. Both willow species formed ectomycorrhizas with Amanita spp., Cortinarius purpurascens, Entoloma nidorosum and other Entoloma spp., Hebeloma crustuliniforme, H. pusillum, Laccaria bicolor, and Paxillus involutus in greenhouse experiments. Field trials on a mined peatland site revealed (after one growing season) statistically significant growth stimultion due to inoculation, but these results were sometimes attributable to non-symbiotic effects of inoculation. Inoculation with some Entoloma isolates resulted in additional field growth stimulation due to symbiotic effects both willow species: plants inoculated with Entoloma were sometimes twice as large as control plants. however, such effects were observed only in plots receiving normal phosphate fertilization 40-80 kg as opposed to low 10-40 kg application and were not consistent from season to season.

10903 **(SAND—88-7032) Silicon concentrator solar cell research.** Green, M.A.; Jianhua, Zhao; Aihua, Wang; Blakers, A.W.; Chong, C.M.; Fuzu, Zhang; Sproul, A; Wenham, S.R.; Campbell, P. (Sandia National Labs., Albuquerque, NM (USA); New South Wales Univ., Kensington (Australia). Solar Photovoltaic Lab.). Dec 1988. Contract AC04-76DP00789. 141p. NTIS, PC A07/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005490/JAW.

Research directed at improving the energy conversion efficiency of silicon concentrator solar cells over the year ending October 1987 is described. The most promising approach identified for fabricating high-efficiency, bifacially contacted cells is one whereby the effects of top metallization shading can be negated, such as by the use of prismatic covers. This approach is shown to be capable of producing 25% cell efficiency for relatively large-area cells for concentration in the 100--500 suns range. Increase beyond this efficiency figure is dependent upon improvements in rear surface passivation. Results reported include the first demonstration of 19% lens/cell efficiency with silicon, the demonstration of improved performance levels for bifacially contacted high-resistivity cells, and the demonstration of the feasibility of applying the laser-grooved approach to large-area, low-cost concentrator cells. The theory of sublinear effects in high-resistivity cells is developed and shown to accurately describe experimental results. Finally, a new light-trapping scheme based on tilted pyramids and slats is analyzed and shown to perform better than any other scheme analyzed to date. 32 refs., 34 figs., 20 tabs.

10904 **(SAND—88-7033) Continued development of metallization for GaAs concentrator cells.** Tobin, S.P. (Sandia National Labs., Albuquerque, NM (USA)). Nov 1988. Contract AC04-76DP00789. 126p. NTIS, PC A07/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005491/JAW.

The objective of this work was the integration of thermally stable metallizations with a high-efficiency GaAs concentrator cell process. For p-GaAs we used a Pt-TiN-Au metallization developed under a previous Sandia Contract. For n-GaAs the best results were obtained for AuGe-TiN-Au. Baseline p/n cells with a CrAu metallization achieved efficiencies of 25.4% at 200 suns. Efficiencies were about 22% at one sun. At one sun, p/n cells with high-temperature contacts were 22.2% efficient, showing that there is no efficiency penalty with the high-temperature metallization. Development efforts on n/p cells yielded high short-circuit currents and open-circuit voltages, with both conventional and high-temperature metallizations. Thermal annealing tests showed that cells with the Pt-TiN-Au metallization were more stable than those with the baseline metallization, withstanding a 15-minute anneal at 500{degree}C with negligible efficiency degradation. 22 refs., 64 figs., 54 tabs.

10905 **(SLU-IVL—196) Storage of chunk wood in smaller piles.** Nilsson, T. (Linkoeping Univ. (Sweden). Dept. of Mathematics). Nov 1987. 66p. (In Swedish). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88755852/JAW.

Studies were made of differences in changes in energy value and growth of micro-fungi when storing two different lengths of chunk wood in smaller piles in addition, changes in moisture content during storage were studied as a function of the location of the measurement points in the pile for different types of fuel and material. The investigation consisted of one treatment comprising two fuel piles. One pile consisted of chunk wood with mean lengths of 60-80mm and the other of chunk wood with a 120-140 mm mean length. The material for the study consisted of unlimbed whole tree parts from a stand cleaned for the first time, where the cleaned material consisted to 95 percent of coniferous trees. Each pile consisted of about 55 m/sup 3/ chunk wood and the storage was done in the open. The average dry matter loss in chunk wood of 60-80 mm and 120-140 mm was found to be 13.1% and 19.1% respectively. The energy changes in both types of chunk wood were negative. In 60-80 and 120-140 mm chunk wood the energy content after storage had decreased by 11.4% and 15.5% respectively. After storage both the total number of micro-fungal spores and the total number of viable micro-fungal spores were lower in the 60-80 mm chunk wood than in the 120-140 mm chunk wood. By studying the change in moisture content as a function of the position of the measurement points in the pile for different fuel types and original material, it was possible to make the following classification: -Compact pile with dominating free ventilation. -Porous pile with dominating forced ventilation. -Intermediate pile with both types of ventilation.

10906 **(STEV-EO—88-8) Development of energy forest harvester.** Albertsson, N.; Nilsson, K. (Ferator, Oernskoeldsvik (SE)). (Statens Energiverk, Stockholm (Sweden)). 1988. 54p. (In Swedish). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88755875/JAW.

The proposal is based on a system made of a tractor with detachable harvesting equipment. The material is left on the field to be collected later. The specifications are adapted to the current situation. New harvesting methods are suggested. Harvesting and management cost of energy forestry are presented. (G.B.).

10907 **(STEV-NYEL—88-8) Solar cells for energy production.** Andersson, M.; Hedstroem, J.; Jargelius, M.; Niemi, E.; Sigurd, D.; Stolt, L. (Institutet foer Mikrovagsteknik, Stockholm (Sweden)). (Statens Energiverk, Stockholm (Sweden)). 16 Sep 1988. 62p. (In Swedish, English). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88755881/JAW.

This progress report covers the period from 1986-07 to 1988-06 and deals with the state of the art of solar cells. The experience from a number of solar cell power plants near Stockholm is presented. The experimental activities concerning thin film cells at the Institute of Microelectronics are reported. The expenditures during the period amount to 3 MSEK. (G.B.).

10908 **(STEV-TB—88-6) Fuel consumption as cost indicator.** Svanqvist, N. (9850100SE;). (Statens Energiverk, Stockholm (Sweden)). 1988. 51p. (SLU-ISK-U—11-1985). NTIS (US Sales Only), PC A04. Order Number DE88755882/JAW.

The scope of the study is to update the data files from 1979 and 1982 concerning forest machine costs and determine changes in these costs over time. Machine costs as a function of fuel consumption is derived. The share of fuel of the total cost has increased from 6 to 13 percent since 1978. (G.B.).

10909 **(STEV-TB—88-9) Power requirement and energy consumption in fuel-chip production using a tractor-mounted chipper.** Liss, J.E. (Swedish Univ. of Agricultural Sciences, Garpenberg. Dept. of Operational Efficiency). (Statens Energiverk, Stockholm (Sweden); Swedish Univ. of Agricultural Sciences, Garpenberg. Dept. of Operational Efficiency). Apr 1987. 138p. (In Swedish). (SLU-ISK—173). NTIS (US Sales Only), PC A07. Order Number DE88755884/JAW.

The purpose of this investigation is to gather information about power requirement and energy consumption in the use of tractor-mounted chippers - knowledge which can be used for development of techniques and for the design of studies in practical operation. The report points out the importance of e.g. the timber diameter and other wood characteristics, temperature, the number of cutting tools and the cutting speed. Measures for increasing effectivity and operational adaptions with regard to the varying conditions and needs of forest owners/workers are discussed in the final section.

10910 **(STU-I—636) Mini combined heat and power plants at a sawmill.** Kjellstroem, B.; Fors, J.; Rundstroem, T. (Exergetics AB, Vagnhaerad (SE); Teknikgruppen AB, Solna (SE); Energiteknisk Utveckling AB, Trosa (SE)). (Swedish National Board for Technical Development, Stockholm). Oct 1987. 156p. (In Swedish). NTIS (US Sales Only), PC A08/MF A01. Order Number DE88755906/JAW.

Three cogeneration alternatives have been studied for a saw mill, where wood waste is used as a fuel. The results are primarily applicable to the Torsaas saw mill, but are probably valid for saw mills in general, with production volumes of 30 - 100 000 m/sup 3//year, or for district heating centrals with a heating load 1-3 MW. A plant with a steam motor presents the lowest technical risk at present. The combination of a producer gas generator and an internal combustion engine offers the best economic potential, but needs development and testing. Gas turbines do not seem to be competitive at the power range studied. Economic evaluations were made of the steam motor and producer gas alternatives. Neither alternative is profitable with the present electricity prices in Sweden. The electricity producing cost are 250-270 SEK/MWh (39-42 $/MWh) for both types of plant, if the installation is done in connection with the replacement of a worn-out boiler. The report is divided in four parts, one main report and three annexes for the three alternatives studied. (L.E.).

10911 **Defect chemical explanation for the effect of air anneal on CdS/CuInSe$_2$ solar cell performance.** Cahen, D.; Noufi, R. (Structural Chemistry Department, Weizmann Institute of Science, Rehovot 76100, Israel). *Applied Physics Letters;* **54**: No. 6, 558-560(6 Feb 1989).

We formulate a consistent defect chemical model of the effect of air/O_2 anneals on CdS/CuInSe$_2$ devices. The model centers on O-induced neutralization of (near) surface donor states in CuInSe$_2$ grains. The simplest identification of these states is with ionized Se vacancies, due to coordinatively unsaturated In on grain surfaces and boundaries.

1406 Photovoltaic Power Systems

REFER ALSO TO CITATION(S) 10882

10912 **(N—89-10122) Photovoltaics for high capacity space power systems.** Flood, D.J. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). Oct 1988. 16p. (NASA-TM—101341; E—4360; NAS—1.15:101341; CONF-8810156—). NTIS, PC A03/MF A01.

From International Astronautical Federation (IAF) symposium on economics of space operations; Bangalore, India (8 Oct 1988).

The anticipated energy requirements of future space missions will grow by factors approaching 100 or more, particularly as a permanent manned presence is established in space. The advances that can be expected in solar array performance and lifetime, when coupled with advanced, high energy density storage batteries and/or fuel cells, will continue to make photovoltaic energy conversion a viable power generating option for the large systems of the future. The specific technologies required to satisfy any particular set of power requirements will vary from mission to mission. Nonetheless, in almost all cases the technology push will be toward lighter weight and higher efficiency, whether of solar arrays or storage devices. This paper will describe the content and direction of the current NASA program in space photovoltaic technology. The paper will also discuss projected system level capabilities of photovoltaic power systems in the context of some of the new mission opportunities under study by NASA, such as a manned lunar base, and a manned visit to Mars.

1407 Solar Thermal Power Systems

REFER ALSO TO CITATION(S) 10912, 11215

10913 **(DOE/AL/38741—1-Vol.1) Arizona public service utility solar central receiver study: Volume 1, Phase 1 topical report.** (Arizona Public Service Co., Phoenix (USA)). Nov 1988. Contract FC04-86AL38741. 370p. NTIS, PC A16/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004458/JAW.

The Arizona Public Service Company (APS), in association with Black and Veatch (B&V), Babcock and Wilcox (B&W), Solar Power Engineering Company (SPECO), Pitt-DesMoines (PDM), and the University of Houston (UH), has completed Phase I of the Utility Solar Central Receiver Study. This study was co-funded by the US Department of Energy (DOE) under Cooperative Agreement Number DE-FC04-86AL38741. The Phase I effort focused on defining the most cost-effective solar thermal central receiver (STCR) power plant configuration for commercial utility application. A team led by Pacific Gas & Electric (PG&E) performed a similar parallel effort; in addition, the Alternate Utility Team (AUT) under APS management completed work for Phase I to support the overall effort. By the conclusion of Phase I, the utilities had reached consensus on the key technical issues for the STCR technology and had performed assessments of the technology which showed similar and favorable economic potential in the commercial utility market. Furthermore, APS and PG&E have agreed to an integrated approach for Phase II to assess and mitigate key risk issues on the path to commercializing the technology. This topical report documents the Phase I efforts; a separate Phase II report will be submitted upon completion of Phase II. 114 figs., 74 tabs.

10914 **(DOE/AL/38741—1-Vol.2) Arizona public service utility solar central receiver study: Volume 2, Appendices.** (Arizona Public Service Co., Phoenix (USA)). Nov 1988. Contract FC04-86AL38741. 213p. NTIS, PC A10 - OSTI. Order Number TI89004459/JAW.

Appendices are included in this report to provide additional detail and support for various sections of the main body. The following appendices are included. Appendix A--Guidelines for Trade Studies and Conceptual Designs. Guidelines issued by APS and PG&E to provide guidance and a starting point for the trade studies. The document provides basic design values for various plant systems and cost estimating. Appendix B--Allowable Flux Levels on Tube-Type Receivers. Summary of a design method for determining the allowable flux levels on a receiver. This method was presented at a workshop conducted by SNL at the CRTF. Appendix C--Molten Salt Storage tank Data. Detailed information provided by CBI regarding their cost estimates and design of the thermal storage tanks. Appendix D--Salt Maintenance. Detailed information provided by Olin Chemical regarding the use of nitrate salt and design considerations necessitated by this use.

10915 **(DOE/AL/38741—2-Vol.1) Alternate Utility Team Utility Solar Central Receiver Study: Final report.** (Arizona Public Service Co., Phoenix (USA)). Sep 1988. Contract FC04-86AL38741. 170p. NTIS, PC A08/MF A01 - OSTI; 1; GPO Dep. Order Number TI89004456/JAW.

The Alternate Utility Team (AUT) was formed under the management of the Arizona Public Service Company (APS) to perform work on the Utility Solar Central Receiver Study. This effort was sponsored by the US Department of Energy (DOE) under Cooperative Agreement Number FC04-86AL38741. Complementary study efforts were also performed by an APS team and a Pacific Gas and Electric Company (PG and E) team. The AUT comprises APS, Black and Veatch, Engineers-Architects, Foster Wheeler (FW), CBI Industries (CBI), University of Houston (UH), Olin Chemicals, and Precision Controls and Instrumentation. The work performed by the AUT included development of common data which were shared with and used by the other two teams. The AUT also conducted trade studies to optimize the commercial scale solar central receiver plant. This final report documents the work of the AUT. 9 refs., 36 figs., 26 tabs.

10916 **(DOE/AL/38741—2-Vol.2) Alternate utility team utility solar central receiver study: Volume 2, Appendices: Final report.** (Arizona Public Service Co., Phoenix (USA)). Sep 1988. Contract FC04-86AL38741. 236p. NTIS, PC A11/MF A01 - OSTI; 1; GPO Dep. Order Number TI89004457/JAW.

Appendices are included in this report to provide additional detail and support for various sections of the main body. The following appendices are included. Appendix A--Guidelines for Trade Studies and Conceptual Designs. Guidelines issued by APS and PG&E to provide guidance and a starting point for the trade studies. The document provides basic design values for various plant systems and cost estimating. Appendix B--Allowable Flux Levels on Tube-Type Receivers. Summary of a design method for determining the allowable flux levels on a receiver. This method was presented at a workshop conducted by SNL at the CRTF. Appendix C--Molten Salt Storage tank Data. Detailed information provided by CBI regarding their cost estimates and design of the thermal storage tanks. Appendix D--Salt Maintenance. Detailed information provided by Olin Chemical regarding the use of nitrate salt and design considerations necessitated by this use.

10917 **(DOE/CH/10093—36) Solar thermal technology annual report: Fiscal year 1987.** (Sandia National Labs., Albuquerque, NM (USA); Solar Energy Research Inst., Golden, CO (USA)). Sep 1988. Contract AC02-83CH10093. 69p. NTIS, PC A04/MF A01 - OSTI; 1; GPO Dep. Order Number DE89000818/JAW.

This annual report describes the accomplishments and progress of government-funded activities initiated, renewed, or completed during Fiscal Year (FY) 1987 (October 1, 1986, through September 30, 1987). It highlights the program tasks conducted by participating federal laboratories and by industrial, academic, or other research under a subcontract. The emphasis of the Solar Thermal Technology Program during the year was (1) to perform research and development leading to the economic viability of two primary solar thermal concepts, central receiver and parabolic dish, and (2) to explore applications of national significance where the special attributes of concentrated sunlight are appropriate. The report includes three appendices that cover principal contacts and sources of additional information (Appendix A), acronyms and abbreviations (Appendix B), and a glossary of terms (Appendix C). A bibliography of relevant publications from Sandia National Laboratories and the Solar Energy Research Institute completes this annual report.

10918 **(NEI-DK—110) Directions for use and documentation for "flowsol", a PC-program for calculating the fluid flow distribution in solar collectors.** Nielsen, J.E.; Ravn, O. (Teknologisk Inst., Taastrup (Denmark). Proevestationen for Solvarmeanlaeg). 1988. 41p. (In Danish). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755791/JAW.

"Flowsol" is a computer program made for IBM-compatible personal computers, and can be used for calculating liquid flow distribution when designing solar collectors. The version given demands a co-processer and a VGA/EGA screen. The distribution is worked out for five different liquid flows in the interval of 0,1-2,0 1/min. pr. m2. The loss of pressure over the collector during that interval is rechoned and is stated as a function of the total volume flow in the collector. The calculation of liquid flow distribution in linked solar collectors is also worked out by calculating five different liquid flows, between 0,1 and 2,0 1/min. pr. m2 solar collector, and the total loss of pressure is given as a function of the volume flow in the collectors. The results must be considered as guidelines. The author explains the mathematical principles that the program builds on, which are based on Kirchhof's law on a hydraulic circulation, and then continiues to explain how to use the program. (AB).

10919 **(SERI/TP—253-3412) Hydrodynamic, thermal, and radiative transfer behavior of molten salt films as applied to the direct absorption receiver concept.** Green, H.J.; Bohn, M.S.; Carasso, M. (Solar Energy Research Inst., Golden, CO (USA)). Oct 1988. Contract AC02-83CH10093. 22p. (CONF-880655—8). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89000819/JAW.

From 4. international symposium on research, development and applications of solar thermal technology; Santa Fe, NM, USA (13 Jun 1988).

The direct absorption receiver (DAR) is a solar thermal central receiver concept that, in contrast to state-of-the-art tubular receivers, directly exposes a flow of the working fluid to concentrated solar flux. Recent research indicates that using molten salts as the working fluid is technically feasible and economically beneficial. The molten salt flows down a near-vertical support surface and is exposed to the direct solar flux concentrated by a field of heliostats. 20 refs., 8 figs., 3 tabs.

10920 **(STEV-NYEL—88-7) International 30 MWe tower power plant for solar energy. PHOEBUS project phase 1A. Final report.** Loosme, M. (K-Konsult, Stockholm (SE)). (Statens Energiverk, Stockholm (Sweden)). Jun 1988. 28p. (In Swedish). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755880/JAW.

The aim of the project is to optimize the technique and operational strategy for a tower solar power plant and to demonstrate the feasibility of reliable and commercially competitive electric power production. Four solar energy systems have been studied and comparative evaluations have been based on equal meteorological, technical and economical data. (G.B.).

1409 Solar Thermal Utilization

REFER ALSO TO CITATION(S) 10917, 10929, 11234

10921 **(AFME—85-04-1094) Solar water heating: design and thermal calculations.** (Agence Francaise pour la Maitrise de l'Energie, 75 - Paris). 1985. 47p. (In French). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756325/JAW.

A simple method for the design and realization of solar heating facilities is described. Energy recovery is evaluated and the results of a simulation study of solar energy recovery confirmed by test results in real site and laboratory experiments are presented.

10922 **(AU/EE—1980) A study of air-mediated solar heating systems with long-term storage.** Robinson, A.M.; Cuthiell, D.L.; Hargrove, W.H.; Haswell, P. (Alberta Univ., Edmonton (Canada). Dept. of Electrical Engineering). 1980. 20p. (CE—02136). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

This report covers the first 6 months of a project intended to produce a computer model of the system performance of an air-mediated long-term storage solar heating system for a single-family house in Canada. The first phase of the project involved an assessment of some of the computer models currently available, and the second phase attempted to develop a simplified model in order to indicate trends in the study and aid in the preparation of a final model. It was found appropriate to examine the two extreme kinds of models available, the hourly type and the monthly-average type. The hourly models were flexible and adaptable to describe an air-collector, seasonal-storage system. Two such models, TRNSYS and WATSUN, were chosen as valuable tools for providing reference points in developing simpler models. Two simple models were constructed which describe a seasonal heating system using only monthly average inputs: this was done by integrating the heat balance equation replacing instantaneous quantities by monthly averages. The greatest problem with the simplified models is that they did not take into account periods when the solar collector would be turned off (i.e. when collector losses exceed gains). Preliminary work is outlined for a compromise model, which would improve the accuracy of a monthly-average calculation without going to the cost and complexity of an hourly calculation. Such a model would involve incorporating as input some details of the statistical distribution of radiation. In this approach, most computational effort would go into determining the hourly variation of insolation for a particular area, which could then be used in all further simulations. 3 figs.

10923 **(DOE/SF/16735—T1) Vanadium oxide thermochromic materials for optical switching films: Final technical report, May 8, 1987--August 31, 1988.** Jorgenson, G.V. (Honeywell, Inc., Minneapolis, MN (USA). Systems and Research Div.). 21 Dec 1988. Contract AC03-87SF16735. 16p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005008/JAW.

A reactive ion beam sputtering deposition system was used to deposit doped vanadium dioxide (V/sub 1-x/M/sub x/O_2), where M is the dopant that decreases the transition temperature (T/sub t/) from that of stoichiometric VO_2. In a previous program (Contract No. DE-ACO3-84SF15295) we studied the effects of using W and Nb as dopants. In this program, the dopant for these thin film studies (Task 1) was Mo. The technique was reactive ion beam sputtering of vanadium and the dopant (Mo) in a well controlled atmosphere of Ar with a partial pressure of O_2. The films were deposited at a temperature of {approximately}780K onto sapphire substrates for spectrophotometric evaluation above and below T/sub t/. The outcome was that the earlier work with W as the dopant yielded better results. Based on that outcome, W was used in experiments to develop doped vanadium oxide paint pigments that would switch at {approximately}285K (12{degree}C). Switchable VO_2 pigments were made, as was paint based on those pigments. Also, switchable W-doped pigments were synthesized with transition temperatures down to 276K (3{degree}C). The technique was to mix equimolecular portions of V_2O_3 and V_2O_5 powder to produce V_2O_4 (VO_2). These powders were heated at high temperature for several days. The W doping was achieved by mixing W and WO_3 (W_2O_3) and substituting that for some of the V_2O_3. The longer range goals for this research are to develop paints that will switch between being absorbing and reflecting. A wall with such a paint will absorb solar energy at temperatures below T/sub t/ and reflect the energy when at temperatures above T/sub t/. 5 refs., 5 figs., 1 tab.

10924 **(GB—173) Potential for small-scale solar-powered irrigation in Pakistan.** Howes, M. (Sussex Univ., Brighton (UK). Inst. of Development Studies). Dec 1982. 41p. British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks., LS23 7BQ. Ref. 88/18444.

A report is given on the field trials in Pakistan of solar-powered irrigation pump sets. The set is a seven panel system costing $6200 (1981 prices). In comparison with the traditional ox-drawn Persian Wheel, both the existing solar-powered irrigation pump sets and even newer improved versions are unlikely to compete without subsidy. The final section deals with the likely social and income distribution implications arising from the introduction of solar pumping technology. (U.K.).

10925 **(OUP—88-16) Solar heated air dryer for high mountain operation.** Andersen, S.L.; Espe, I.; Herbjoernsen, O.; Bergsbakken, E.M.; Bergsbakken, Aa. (Oslo Univ. (Norway). Fysisk Inst.). Oct 1988. 64p. (In Norwegian). NTIS (US Sales Only), PC A04. Order Number DE88755838/JAW.

The report deals with an evaluation of a solar heated air dryer designed for the drying of reaped grass in mountainous areas. The solar collectors are designed as an integrated part of a roofing system. The measuring methods together with the results from the measurements are presented. 19 figures.

10926 **(PB—89-107932/XAB) Investment opportunity: the FPL (Forest Products Laboratory) low-cost solar-dry kiln.** Harpole, G.B. (Forest Service, Madison, WI (USA). Forest Products Lab.). Sep 1988. 9p. (FPL-GTR—58). NTIS, PC A02/MF A01.

Two equations are presented that may be used to estimate a maximum investment limit and working capital requirements for the FPL low-cost solar-dry kiln systems. The equations require data for drying-cycle time, green-lumber cost, and kiln-dried lumber costs. Results are intended to provide a preliminary estimate.

10927 (SESC—8806, pp 328-332) **Estimating seasonal output of solar domestic hot water systems from standard day test results.** Thwaites, J.D.R.; Harrison, S.J. (Queen's Univ., Kingston, Ont.). 1988. Solar Energy Society of Canada, Inc., Winnipeg, Manitoba. (CONF-8806251—; CE—01931).

From 14. annual conference of the Solar Energy Society of Canada, Inc.; Ottawa, Canada (22 Jun 1988).

Methods for estimating the annual output of solar domestic hot water (SDHW) systems from Standard Day Tests have been shown for systems operating year round. In this study, the feasibility of predicting the long term performance of seasonal SDHW systems from Standard Day Test Results was investigated. Using the Typical Meteorological Year data from the WATSUN simulation program, weather patterns were studied to determine the length of operating seasons in Canadian eight cities. A correlation was developed between season length, the system's performance in a Standard Day Test and the seasonal output of the system. The results of this study show that the performance of seasonal systems for different locations may be easily predicted from Standard Day Test Results. 5 refs., 4 figs., 1 tab.

10928 **(SP-RAPP—27) Solar collectors - Sealing and insulating materials outgassing.** Eriksson-Widblom, K. (Statens Provningsanstalt, Boraes (Sweden); Statens Raad foer Byggnadsforskning, Stockholm (Sweden)). 1987. 52p. (In Swedish). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88755871/JAW.

One reason for a reduced function in many solar collectors is that the covering plate is fogged by the volatile components in the sealing and insulation products. This so called outgassing also dete-

riorates the functions of the components. A rubber gasket e.g. hardens when the softener evaporates and the function of the sealing deteriorates. Several investigations of the outgassing tendency in solar collectors have been published. Many materials are unsuitable from the point of outgassing. A method for determination of outgassing has been developed within the scope of this project. The sealing and insulation materials used in solar collectors, made in Sweden, have been examined and investigated. The results show that outgassing from the products even happens at a temperature used by normal use. With a temperature corresponding to a stagnation situation e.g. circulation failure, the quantity of volatile components is considerable.

1410 Solar Collectors And Concentrators

REFER ALSO TO CITATION(S) 10917

10929 (DOE/SF/16306—T1) Evaluation of a boiling collector solar heating system: Final report, June 1986--May 1987. Loef, G.O.G.; Brisbane, T.; Coughlan, B.; Walker, H.; Davidson, J. (Colorado State Univ., Fort Collins (USA). Solar Energy Applications Lab.). May 1988. Contract FG03-86SF16306. 61p. (SAN—16306-2). NTIS, PC A04/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005006/JAW.

An experimental study of a pilot scale, self-pumping solar system utilizing a boiling collector is presented. The advantage of a self-pumping solar system is the elimination of the need for either a mechanical pump or controller. In such a system, the vapor pressure not only drives the vapor from the elevated collector to the condenser but also forces the return of the condensed liquid to the collector. The primary objectives of this study were to confirm the viability of the self-pumping design concept and to identify ways in which the system can be optimized. The pilot system is configured with a single solar collector panel, a separator, two refrigerant accumulators, a small refrigerant reservoir, a tube-in-shell heat exchanger, two water storage tanks and associated piping and valves. The system operates in two alternating cycles. During the run cycle, liquid refrigerant, R-113, is gravity-fed to the roof-mounted collector from an attic accumulator tank and a small auxiliary reservoir. Vapor exiting the collector is condensed and then collected in an accumulator at ground level. Once the liquid refrigerant stored in the upper accumulator is depleted the system switches to the pump cycle in which condensed refrigerant is returned to the elevated solar collector by utilizing the pressure differential created by vapor pressure build-up in the collector. 2 refs., 19 figs., 7 tabs.

10930 (NRC/E—COLL-9) Development of a fixed position, fixed configuration air heating solar collector. Shewen, E.C.; Hollands, K.G.T.; Remick, C.D.; Balakrishnan, A.R.; Cummer, G.F.; Lehman, D.C.; Niessen, P.; Pemberton, E.V.; Sullivan, H.F. (National Research Council of Canada, Ottawa, Ontario. Div. of Energy). 1980. 251p. (CE—02192). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

Design considerations for an air heating solar collector are reviewed in terms of the operating environment, materials requirements, installation considerations, heat transfer design, and potential operating problems. In considering heat transfer, particular emphasis is given to methods for imroving the absorber-to-fluid heat transfer by using a short path concept, and to factors fixing a design pressure drop. Air leakage was determined to be an important factor affecting collector performance, and a design leakage rate of 1% was fixed. Dimensioning, arranging, and installing collector modules was also examined, considering such parameters as ease of manufacture and installation. Prototype collectors were designed and fabricated; 14 of these were performance tested. The design studies included effects of long versus short flow paths, and the use of flat plates and V-corrugated absorber plates. A number of technical problems prevented definitive statements on the experimental verification of an expected performance improvement using short-path designs; however, there was definite improvement due to V-corrugating. The effects of low-Fe and high-Fe glass, Teflon inner covers, black paint and black chrome selective surfaces were also studied. Performance predictions were made of all the design alternatives, and were used to determine the cost effectiveness of these alternatives for a Toronto installation. The most cost-effective design was found to be a long-path, flat design using a solar selective surface. a Teflon inner cover and a glass outer cover. 46 refs., 60 figs., 18 tabs.

10931 (ORF—CORR-1) Protecting solar collector systems from corrosion. (Ontario Research Foundation, Sheridan Park (Canada)). [1978]. 32p. (CE—02185). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

The main cause of the reduced life of a solar heating system is corrosion of the exterior parts and the internal components. This report outlines ways of reducing the cost of solar heating by reducing the corrosion in solar heating systems, and hence increasing the system's service life. Mechanisms for corrosion are discussed: these include galvanic corrosion and crevice corrosion. Means of minimizing corrosion at the design stage are then described. Such methods, when designing the solar collector, involve ensuring proper drainage of exterior water; eliminating situations where moisture, dirt and pollutants may collect; preventing condensation inside the collector; using proper gaskets and sealants at appropriate places; and selecting optimum materials and coatings. Interior corrosion can be minimized at the design stage by choosing a good heat transfer fluid and corrosion inhibitor, in the case of systems where liquids are used; ensuring a low enough flow rate to avoid erosion; designing the system to avoid crevices; and avoiding situations where galvanic corrosion could occur. Other procedures are given for minimizing corrosion in the construction and operation of solar heating systems. 7 figs., 7 tabs.

10932 (OUP—88-15) Corrugated plate solar air heater. Trade-offs between efficiency and pressure drop. Choudhury, C. (Oslo Univ. (Norway). Fysisk Inst.). Sep 1988. 24p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755837/JAW.

The report deals with a corrugated plate solar air heater, and discusses the trade-offs between efficiency and pressure drop. In any solar heating system, larger air flow velocities with shallower air passage depths result in higher air temperature increment and higher collection efficiences but also in increased pressure drop and hence, in increased fan running costs of the system. To determine a reasonable compromising point, a detailed theoretical parametric analysis have been made of a corrugated plate solar air heater involving the effects of air flow velocities (or air channel depths) on the air temperature increment, efficiency and the pressure drop experienced by the flowing air for different air channel lengths and different specific mass flow rates of air in the heater. The process of optimization discussed in the article would enable a designer to construct economical and efficient solar air heaters with technically logical air passage dimensions. 11 figures.

10933 (OUP—88-18) Corrugated plate solar air heater: performance strategies. Choudhury, C. (Oslo Univ. (Norway). Fysisk Inst.). Nov 1988. 27p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755839/JAW.

The report deals with the performance strategies of a corrugated plate solar air heater. Theoretical investigations have been made on a one pass corrugated plate solar air heater with the heat transfer fluid air flowing above the absorber plate to work out its efficiency when provided with single covers of different plastics and glass, and double-wall covers of polycarbonate without and with slats (both along length and along width of the air heater) in between the adjacent walls with different slat angles, aspect ratios and cover wall interspacings. System with single cover of acrylic was observed to have higher efficiency as compared to the ones with single covers of other plastics and glass. In case of air heaters with double-wall polycarbonate cover sheets, slated covers with close ends were observed to perform superior to those with unslated ones for all aspect ratios and cover wall inter-spacings. 8 figures.

10934 **(SIM—COLL-10) Heron Gate solar energy project - the cause and remedy of leaks in the Solco 4E solar collector.** Atkinson, J.A. (Solatherm, Inc., Mississauga, Ontario (Canada)). 1980. 13p. (CE—02188). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

This report documents technical data relevant to the failure, investigation of, and subsequent repair to the absorber riser tube and collector header pipe assembly in the Solco Model 4E flat plate collectors, installed at a housing project in Ottawa. The collectors supplied for this project were among the first of this model to be manufactured by Solco in April 1978. In the eight month period following installation, a leakage problem was studied and a number of options considered to resolve this problem. Initially the installing contractor attempted to repair the defective panels but eventually the entire shipment was returned to the manufacturer for complete rebuilding. A number of potential solutions were investigated but the basic problem was found to be with the grade of solder used. It was found that the solder recommended for this application was not suitable under the high temperatures to which a solar collector may be exposed. Although the solder may have been adequate for punched or T-drilled headers, having a greater area of metal to metal contact with the absorber tubes, a high temperature brazing alloy was eventually found to be the most reliable means of assembling the tubesheets. The collectors have been reinstalled at the jobsite and no problems have occurred since. 5 figs.

10935 **(STU—85-5143) Solar concentrators for photovoltaic cells.** Broman, L.; Nordlander, S.; Roennelid, M. (Hoegskolan i Falun/Borlaenge (SE). Centrum foer solenergiforskning). (Swedish National Board for Technical Development, Stockholm). Nov 1987. 29p. (In Swedish). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755901/JAW.

Geometries for solar concentrators with moderate concentration factors are given in this report. All reflectors described are built from plane sheets. Intensity distribution, materials consumption, and angles of acceptance are calculated. Main areas of application are probably small industries in developing countries and leisure activities in Sweden. (L.E.).

1420 Heat Storage

REFER ALSO TO CITATION(S) 10922

10936 **(FRNC-TH—3255) Analysis and optimal control of distributed bilinear systems: application to energy processus.** El Alami, N. (Perpignan Univ., 66 (France)). 1986. 137p. (In French). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88756321/JAW.

The study deals with the analysis and optimal control with quadratiC cost of distributed bilinear systems and the formulation of numerical algorithms. Two applications are developed: control of a sensible heat storage system in porous media and control of a heat pump (solid/gas reactors).

10937 **(NRC/E—STOR-6) A heat storage subsystem for solar energy. Phase 2. Final report.** Shewan, E.C.; Sullivan, H.F.; Hollands, K.G.T.; Balakrishnan, A.R. (National Research Council of Canada, Ottawa, Ontario. Div. of Energy). 1978. 100p. (CE—02186). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

This report describes work performed on an experimental study of the performance characteristics of a rock bed sensible energy storage device. A flow distribution study indicated that a minimum pressure drop across the bed of ca 40 pascals was required to achieve a uniform flow distribution through the bed. In order to design the bed for such a pressure drop, good correlation equations must be available which predict the drop as a function of bed height, rock size, and flow velocity. The best such equations found in the literature were not felt to have a high certainty of prediction for the range of rock types that must be expected. Consequently, a design pressure drop of 55 pascals is recommended to allow for a margin of safety. Thermal tests, performed with downward air flow in the charging cycle and upward flow in the discharging cycle, confirmed the existence of relatively sharp temperature wavefronts moving through the bed. Forced convective heat transfer coefficients from the bed to the moving air were determined by comparing the shape of the measured wavefront with the predictions of the Mumma and Marvin method. A static test was performed in which a partially charged bed was allowed to sit for several days without air flowing through it, simulating a condition which may arise in an actual system. The tests showed that the bed will maintain stratification for a period of about 3 days. As part of this study, the construction of rock bed containers was examined with the goal of establishing satisfactory designs. Parameters considered included insulation thickness, allowable materials, and structural strength. 14 refs., 34 figs., 2 tabs.

10938 **(NRC/E—STOR-7) Development of a solar-assisted heat pump system with water/ice storage.** (National Research Council of Canada, Ottawa, Ontario. Div. of Energy). 1980. 22p. (CE—02190). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

This report covers work in the integration of a solar collector panel array with an ice/water phase change heat storage system, using a solar assisted heat pump. Solar energy is collected by a solar panel array. Low temperature water is pumped through the array where it rises in temperature and is returned to an inground concrete thermal storage tank. The low grade heat is extracted from storage by a heat pump through submerged evaporator plates. Water is circulated through the heat pump condenser, extracting the upgraded heat and distributing it to the system. The potential benefits of this type of system include the use of inexpensive solar collectors having increased collection efficiency due to low inlet temperature, and uninsulated storage tanks having little, if any, thermal losses. This report describes each stage of the design process in detail. Observations and difficulties encountered during the design and operation of the system are discussed. The project has led to several recommendations for continuing research in this area. Further study should yield an efficient, marketable heat storage and collection system. 7 figs.

10939 **(WU/RI—STOR-8) Rock bed thermal energy storage.** Sullivan, H.F.; Hollands, K.G.T. (Waterloo Univ., Ontario (Canada). Research Inst.). 1980. 65p. (CE—02189). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

This report presents studies on flow uniformity and thermal stratification in rock beds for air-based solar heating systems. Nine different aggregate types were tested for pressure drop Δp characteristics and from these results a pair of new correlation equations for Δp are given. These equations should considerably improve the accuracy of predicting Δps across rock beds so that the minimum Δp of 40 pascals required to give uniformity flow can be designed for with improved confidence. A second study demonstrated that improved flow distribution can be achieved by adding a perforated plate above the bed to increase bed Δp. Thus for those situations where it is (or was) not possible to design for the required Δp from the rocks, perforated plates can be used (or retrofitted) to improve the flow uniformity. Another study indicates that the penalty in total solar system performance associated with a non-uniform flow in the rock bed, with a Δp of 40 pascals is less than 1%. Provided the coefficient of variation of the air velocity across the bed is less than 0.4, the total performance penalty should not exceed 2%. Finally, a test was undertaken to determine if the rate of degradation with time of the stratified temperature distribution in the bed was increased if the bed were charged with hot air from the bottom, rather than from the top. It was concluded that it was not increased, so that the designer can design with confidence for either arrangement. 11 refs., 22 figs. 3 tabs.

15 GEOTHERMAL ENERGY

1503 Geothermal Exploration And Exploration Technology

10940 (LA—11477-OBES) Field procedures manual: INYO-4, Long Valley Caldera, California. Goff, S. (Los Alamos National Lab., NM (USA)). Jan 1989. Contract W-7405-ENG-36. 11p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89005214/JAW.

This Field Procedures Manual is the comprehensive operations guide to be used to curate samples obtained from the INYO-4 site in the Long Valley Caldera. California. This site is a diamond drilling project in small-diameter holes that will produce continuous core. Fluid samples will also be of primary importance at this site. Detailed core and fluid handling procedures are therefore the major focus of this manual. The manual provides a comprehensive operations guide for the well-site geoscientists working at the Department of Energy/Office of Basic Energy Sciences (DOE/OBES) Continental Scientific Drilling Program (CSDP)/Thermal Regimes drill sites. These procedures modify and improve those in previous DOE/OBES field manuals. 1 ref.; 6 figs.

1509 Geothermal Engineering

REFER ALSO TO CITATION(S) 10941

1520 Geothermal Data And Theory

10941 (EGG-M—43887) Dual permeability modeling of solute transport in discrete fracture systems. Miller, J.D.; Clemo, T.M. (EG and G Idaho, Inc., Idaho Falls (USA)). 1988. Contract AC07-76ID01570. 7p. (CONF-880111—7). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005189/JAW.

From 13. workshop on geothermal reservoir engineering; Stanford, CA, USA (19 Jan 1988).

The flow and transport properties of a dual permeability model have been evaluated in a form which allows discrete simulation of the complete range of fracture size in a series of successively larger models up to reservoir scale. In matrix dual permeability modeling, the flow and transport processes occur in both matrix cells and the superimposed discrete fractures. The matrix cell models use Darcian flow and Fickian transport relationships to represent processes occurring in the numerous small channels which make up the micro-structure of the rock. The macro-fractures are modeled discretely up to the size of the multi-cell model. If the overall properties of the multi-cell model can be determined, they can be used to represent this model as a single cell in a larger model along with the next larger set of fractures. Since its cells represent the rock matrix and the distributed effect of small fractures, the larger model is termed a distributed or representative element dual permeability model. Successively larger models then allow simulation up to the scale of the reservoir. An initial step in this development has been achieved by numerically determining the non-Darcian, non-Fickian properties of a two-dimensional model composed of Darcian and Fickian matrix cells and a discrete fracture system. The porous matrix properties were assumed to be those measured in a visibly unfractured core. The discrete fracture system was a realization of the smaller fractures in a stochastic system. The FRACSL code was used to determine flow coefficients and residence time distributions for the porous matrix combined with each of five different realizations of the stochastic fracture system. Reservoir scale simulation could be achieved with reasonable computer resources and with fidelity to the fractured media by incorporating this type of results in successively larger models. 10 refs., 8 figs., 2 tabs.

17 WIND ENERGY

10942 (NEI-DK—112) Plan of action for exporting wind turbines to developing countries. (Visionik ApS, Copenhagen (Denmark)). 1988. 33p. (In Danish). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755793/JAW.

The Danish export of wind turbines has decreased by 2/3 since 1986 despite initial enthusiasm. The market has, however, been growing rapidly in India and reasons for this situation, and some prognoses, are offered. Suggested actions for the promotion of the markets in developing countries are cooperation in documenting technical and social/economical data, support for the demonstration of possible applications of wind energy in the relevant developing countries (for example, wind driven water pumps), and training opportunities for exporters to learn about establishing joint ventures, licence contracts, and taking advantage of patent rights. Moreover, the starting-up of development demonstration centers for renewable energy that can function as market development factors and help manufacturers adapt their products to local conditions, should be encouraged. Manufacturers should strive to cooperate with public institutions such as DANIDA and the Foreign Ministry. Marketing initiatives should be combined in order to produce evaluations of local wind resources, descriptions of the markets and to create agressive sales strategies. The authors claim that the activities described have already attracted the interest of many Danish manufacturers. (AB).

1701 Availability (climatology)

REFER ALSO TO CITATION(S) 10952

10943 (OUEL—1709/87) Measurements of wind flow over models of a hill. Parkinson, H.G. (Oxford Univ. (UK). Dept. of Engineering Science). Oct 1987. 246p. British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks., LS23 7BQ.

This report describes an investigation into wind flow over hills, and its relevance to wind turbine siting. Models at three scales have been tested in the 4m x 2m industrial aerodynamics wind tunnel at Oxford. The experiments show that the hill model scale has little effect upon the flow pattern. However, the surface texture of the model is critical, if the full scale behaviour is to be reproduced. The important parameter governing the flow behaviour is a Reynolds number based not on a characteristic dimension of the hill, but on the aerodynamic roughness of the surface. Good agreement between the wind tunnel results and full scale data was found, showing that a wind tunnel can be used as an accurate method to predict changes in both mean and turbulent properties as the flow passes over the hill. Comparison of the present results with the numerical model of Zeman and Jensen shows generally good agreement, increasing the confidence in the theoretical interpretation of the model.

1704 Economics

REFER ALSO TO CITATION(S) 10947

1706 Wind Energy Engineering

REFER ALSO TO CITATION(S) 10881, 11178

10944 (NEI-DK—105) Note on anticorrosion design of wind turbines for agressive environments. Lundsager, P.; Hansen, J.C. (Risoe National Lab., Roskilde (Denmark)). Jan 1986. 9p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88755788/JAW.

A number of non-mandatory guidelines for additional anticorrosion design of wind turbines for aggressive environments are given especially for use in connection with UNSO wind energy projects in developing countries. High temperatures and humidities combined with high salt content of the air cause very rapid corrosion. Anti-corrosion precautions must differ according to individual climatic conditions. Practical measures for corrosion protection are given for each part, for example, blades, gearbox, main brake etc. of a wind turbine. (AB).

10945 **(NEI-DK—108) DENCON windmill - 200/50 kW. Alignment measurements of DENCON windmill - 200/50 kW.** Gjerding, J.B.; Moeller, J. (Tripod Wind Data ApS, Farum (Denmark)). Aug 1987. 42p. (In Danish). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755789/JAW.

From April 17th - June 25th, 1987, alignment measurements were taken on a DENCON windmill 200/50 kW, a prototype of that situated on the island of Aeroe, Denmark. Wind direction and speed, the number of rotations, yaw angle, air temperature and electrical power output were measured in relation to each other. The aim was to clarify the actual efficiency curve and, if necessary, to improve upon it. The operational system was also examined in the light of eventual optimization of the tip angle and control system. The measured efficiency being 230-240 kW would show that the wind turbine produces too much energy in relation to what is expected of this make and type. It is rechoned that if the blades were positioned at -1,2 grades the average efficiency could be kept under 235 kW. As the tip angle during measuring was -1,2 grades it is expected that an angle of -2,5 grades is necessary for regulating efficiency to 200 kW. The turbine, its control system and yaw system in general seem to function satisfactorily. (AB).

10946 **(NEI-DK—125) Implementation of a 55/40 kW wind/diesel system with energy storage in Cape Verde.** Lundsager, P. (Risoe National Lab., Roskilde (Denmark)). Jun 1987. 14p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755805/JAW.

A United Nations project on the Cape Verde islands, which consisted of the establishment of a wind/diesel plant with battery storage facilities, is described. The climatic background, methods of site evaluation and choice of technology are explained in detail. Potential wind energy in Cape Verde is discussed. (AB).

10947 **(NEI-DK—126) Wind/diesel systems for local electricity production.** Lundsager, P.; Hauge Madsen, P. (Risoe National Lab., Roskilde (Denmark)). Sep 1988. 23p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755806/JAW.

Risoe National Laboratory has been actively engaged in wind-diesel technology since 1980, both as an R and D institute and as technical ionsultant in a number of developing countries. The profitability of wind energy systems, especially in remote rural areas, and technologies appropriate to actual situations, are discussed and illustrated by case histories, for example the establishment of a wind - diesel system in Cape Verde. (AB).

10948 **(NRC/E—TM-WE-029) Proceedings of the 5th International Meeting of Test Stations for Small Wind Energy Conversion (IMTSS).** (National Research Council of Canada, Ottawa, Ontario. Div. of Energy). [1988]. 274p. (CONF-8508266—; MICROLOG—88-04410). National Research Council of Canada, Publication Sales and Distribution Office, Montreal Road, Ottawa, Ont., Canada K1A 0R6; $25.00 CAN; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1;.

From 5. international meeting of test stations for small wind energy conversion systems; North Cape, Canada (21 Aug 1985).

A meeting was held to share information and experience related to the testing, evaluation, certification, and standards for wind energy equipment and design. The meeting was highlighted by presentation of current status reports on test stations, presentation of technical reports, a meeting of the European members who are undertaking joint projects, and informal arrangements and contacts. Separate abstracts have been prepared for 19 papers from this meeting.

10949 **(PB—89-121081/XAB) Construction design of the fact-rotor.** Joosse, P.A. (Technische Hogeschool Delft (Netherlands). Inst. voor Windenergie). Dec 1986. 147p. (In Dutch). (IW-R—506). NTIS, PC E06/MF A01.

This report describes the construction design of a windmill wing with a tip vane. The diameter of the rotor is about 9 meters and equipped with a flexbeam. This flexbeam results in low wing-bending rigidity from the rotor plane and low torsion rigidity around the wing axis. The low bending rigidity reduces the dynamic loads on the rotor and the conversion train. By using a tip vane on the wing tip, the energy output can be increased considerably. From a construction point of view, the tip vane results in high tip loads. Advanced synthetic materials were used for the rotor: carbon- and aramid-reinforced epoxy. Carbon-epoxy was chosen because of its excellent rigidity:strength ratio and its high resistance to fatigue. Aramid-epoxy has a high specific rigidity, but it appeared to fall short where fatigue is concerned.

10950 **(PNL—6753) Estimation of turbulence level and scale for wind turbine applications.** Powell, D.C. (Pacific Northwest Lab., Richland, WA (USA)). Nov 1988. Contract AC06-76RL01830. 81p. NTIS, PC A05/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005509/JAW.

A simplified method is presented for estimating onsite turbulence variance within the wind turbine layer for horizontal wind speed. The method is based principally on estimating the probability distribution of wind speed and assigning a variance to each mean wind speed based on surface roughness estimates. The model is not proposed as an alternative to onsite measurement and analysis, but rather as an adjunct to such a program. A revision of the Kaimal neutral u-component spectrum is suggested to apply to the mix of the stabilities occurring during operational winds. Values of integral length scale calculated from data analysis are shown to contradict the length scale model implicit in turbulence power spectra. Also, these calculated values are shown to be extremely sensitive to the length of the time series and the detrending method used. The analysis and modeling are extended to the rotational frame of reference for a horizontal-axis wind turbine by modeling the ratios of harmonic spike variances (1P, 2P, etc.) in the rotational spectrum to the Eulerian turbulence variance. 15 refs., 11 figs., 3 tabs.

10951 **(RISO-M—2600) Wind turbine test Danwin 23 prototype.** Friis Pedersen, T.; Markkilde Petersen, S.; Schmidt Paulsen, U.; Voelund, P. (Risoe National Lab., Roskilde (Denmark)). May 1988. 92p. NTIS (US Sales Only), PC A05. Order Number DE88755844/JAW.

The report describes standard measurements performed on a Danwin 23 180 kW prototype wind turbine. The measurements carried out and reported here comprises the power output, system efficiency, energy production, transmission efficiency, rotor power, rotor efficiency, air-brakes efficiency, structural dynamics, loads at cut-in and braking, rotor torque at stopped condition, yaw errors statistics, and noise emission. (author) 19 tabs., 38 ills., 6 refs.

10952 **(RISO-M—2742) Contributions from the Department of Meteorology and Wind Energy to the ECWEC 88 conference in Herning.** Lundtang Petersen, E. (ed.). (Risoe National Lab., Roskilde (Denmark)). Sep 1988. 68p. (CONF-880646—). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88755849/JAW.

From EEC wind energy conference and exhibition; Herning, Denmark (6 Jun 1988).

The participation of the Department of Meteorology and Wind Energy in the 1988 European Community Wind Energy Conference and Exhibition (ECWEC) 6-10 June 1988, Herning, Denmark involved the presentation of 9 papers and posters by members of the department as authors or co-authors. This report gives the full set of papers and posters. (author) 13 tabs., 67 ills., 94 refs.

10953 **(SERI/STR—217-3320) Local wind measurements for micrositing: Final report.** Walker, S.N.; Wade, J.E. (Solar Energy Research Inst., Golden, CO (USA); Pacific Wind Energy, Corvallis, OR (USA)). Sep 1988. Contract FC02-86CH10251;AC02-83CH10093. 107p. NTIS, PC A06/MF A01 - OSTI; 1; GPO Dep. Order Number DE89000829/JAW.

An important consideration in determining the success or failure of wind energy conversion systems is site wind characteristics. Inadequate micrositing and subsequent poor placement of turbines may result in reductions of annual energy output up to two-thirds of predicted amounts. The objective of this study was to measure the effect of local terrain features on the wind flow at several locations over an array of wind turbines. The study was con-

ducted as part of SERI's Cooperative Field Test Program. The investigation focused on the effect of a 100-ft bluff on wind characteristics. The characteristics investigated included speed, direction, wind speed distribution, turbulence intensity, shear, and power output. The wind energy generation facility at Whisky Run, in southern Oregon, is instrumented with a 350-ft tower in the center of the wind farm with speed and direction sensors at 50, 80, 100, and 200 ft. Four turbines are instrumented at 50 ft (turbines 4, 7, 18, and 21) with speed, direction, and power-output sensors. In addition, three 80-ft towers were instrumented at 50 and 80 ft with anemometers and direction sensors at one or two levels. Hourly and 10-min average data were collected for 1 yr. 37 refs., 47 figs., 36 tabs.

10954 **(SERI/TP—217-3394) Prediction of stochastic blade responses using measured wind-speed data as input to the FLAP code.** Wright, A.D.; Thresher, R.W. (Solar Energy Research Inst., Golden, CO (USA)). Nov 1988. Contract AC02-83CH10093. 8p. (CONF-890102—12). NTIS, PC A02/MF A01 - OSTI. Order Number DE89000834/JAW.

From ASME energy-sources technology conference and exhibition and 7. intersociety cryogenic symposium; Houston, TX, USA (22 Jan 1989).

Accurately predicting wind turbine blade loads and response is important in predicting the fatigue life of wind turbines. The necessity of including turbulent wind effects in structural dynamics model has long been recognized. At SERI, the structural dynamics model, or FLAP (Force and Loads Analysis Program), is being modified to include turbulent wind fluctuations in predicting rotor blade forces and moments. The objective of this paper is to show FLAP code predictions compared to measured blade loads, using actual anemometer array data and a curve-fitting routine to form series expansion coefficients as the turbulence input to FLAP. The predictions are performed for a three-blade upwind field test turbine. An array of nine anemometers was located 0.8 rotor diameters (D) upwind of the turbine, and data from each anemometer are used in a least-squares curve-fitting routine to obtain a series expansion of the turbulence field over the rotor disk. Three 10-min data cases are used to compare FLAP predictions to measured results. Each case represents a different mean wind speed and turbulence intensity. The time series of coefficients in the expansion of the turbulent velocity field are input to the FLAP code. Time series of predicted flap-bending, moments at two blade radial stations are obtained, and power spectra of the predictions are then compared to power spectra of the measured blade bending moments. Conclusions are then drawn about the FLAP code's ability to predict the blade loads for these three data cases. Recommendations for future work are also made. 9 refs., 12 figs., 4 tabs.

10955 **(SERI/TP—217-3413) Prediction of stochastic blade responses using a filtered noise turbulence model in the FLAP [Force and Loads Analysis Program] code.** Thresher, R.W.; Holley, W.E.; Wright, A.D. (Solar Energy Research Inst., Golden, CO (USA)). Nov 1988. Contract AC02-83CH10093. 11p. (CONF-890102—13). NTIS, PC A03/MF A01 - OSTI. Order Number DE89000835/JAW.

From ASME energy-sources technology conference and exhibition and 7. intersociety cryogenic symposium; Houston, TX, USA (22 Jan 1989).

Accurately predicting wind turbine blade loads and resulting stresses is important for predicting the fatigue life of components. There is a clear need within the wind industry for validated codes that can predict not only the deterministic loads from the mean wind velocity, wind shear, and gravity, but also the stochastic loads from turbulent inflow. The FLAP code has already been validated for predicting deterministic loads. This paper concentrates on validating the FLAP code for predicting stochastic turbulence loads using the filtered-noise turbulence model as input. 26 refs., 13 figs., 2 tabs.

10956 **(STEV-VIND—88-3) Influence of residual stress fields on fatigue crack propagation.** Blom, A.F. (Aeronautical Research Inst. of Sweden, Bromma (SE). Structures Department). (Statens Energiverk, Stockholm (Sweden); Aeronautical Research Inst. of Sweden, Bromma). Feb 1987. 44p. (CONF-8703309—; FFA-TN—1987-10). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755886/JAW.

From Residual stresses-origin and influence on material behaviour; Sunne, Sweden (30 Mar 1987).

The general influence of residual stresses on the growth behaviour of fatigue cracks is presented. Different means to introduce beneficial compressive stress fields are discussed, together with a discussion of measurement techniques to estimate the residual stress distributions. It is shown how to derive stress intensity factors for cracks in residual stress fields by means of superposition techniques. The redistribution of residual stress fields during fatigue crack growth is discussed with emphasis on the load history effects encountered in spectrum loading. The paper ends with an analysis of fatigue crack propagation at weldments in an advanced wind energy turbine.

10957 **(STEV-VIND—88-21) Investigation of different ways of reducing moment variations in a wind power plant with induction motor.** Hylander, J. (Chalmers Univ. of Tech., Goeteborg (Sweden). School of Electrical Engineering). (Statens Energiverk, Stockholm (Sweden)). 1988. 23p. (In Swedish). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755887/JAW.

The report investigates some methods to reduce torque peaks in a wind power plant with an induction generator. With transient computer calculations these methods, soft shaft drive train and variable speed operation, are compared with a standard rigid drive train. A short discussion of the most common causes for torque transients in wind power plants with induction generators are also conducted. The torque equations and the computer model for the variable speed operation are presented. The variable speed control are based on a space vector model. The results from the theoretical calculations indicates that there are ways to reduce the severe problems with torque transients on the drive train with an induction generator in a wind power plant operation.

10958 **(STEV-VIND—88-22) Fatigue crack growth data for steel OX 602.** Blom, A.F.; Hedlund-Aastroem, A. (Flygtekniska Foersoeksanstalten, Stockholm (Sweden)). (Statens Energiverk, Stockholm (Sweden); Aeronautical Research Inst. of Sweden, Bromma). 1987. 19p. (FFA-TN—1987-80). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755888/JAW.

This report summarizes the fatigue crack growth data obtained on the steel OX 602 at three different R-values (R=0.2, 0.5 and 0.8). The steel OX 602 has been suggested as a candidate material for welded turbine blades in large wind energy conversion systems and is currently used in a large scale spectrum test programme carried out at FFA. (authors).

10959 **(STEV-VIND—88-23) Estimation of rigidities in a cone-shaped rubber bushing by finite element method.** Nilsson, S.; Zdunek, A.; Linden, G. (Flygtekniska Foersoeksanstalten, Stockholm (Sweden); Trelleborg AB, Trelleborg (SE)). (Statens Energiverk, Stockholm (Sweden); Aeronautical Research Inst. of Sweden, Bromma). 1988. 42p. (In Swedish). (FFA-TN—1987-20). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755889/JAW.

The estimate refers to the swing bearing of elastomer type that was installed in the Maglarp wind power plant. (O.S.).

10960 **(SV-UL—1988-24) Wind-power-energy relations for Swedish wind turbine prototype Naesudden. The final report from full scale experiment.** Dahlberg, J.Aa.; Marcinkiewicz, J.; Tunell, G. (Swedish State Power Board, Aelvkarleby). 19 Aug 1988. 99p. (In Swedish). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88755914/JAW.

The report consists of two separate parts. The first one describes the last stage in the full scale experiment with the prototype 2 MW windpower station at Naesudden, concerning wind, energy and power. This work includes the overall wind-power-relation, analysis of pitchangle-leaps and oblique hub-angle towards wind direction. The second part contains the results of a computer simulation dealing with different start- and stop constraints and their impact on energy production and operation. (authors).

20 ELECTRIC POWER ENGINEERING

2001 Power Plants And Power Generation

REFER ALSO TO CITATION(S) 10674, 10978, 11727

10961 **(EGG-M—37987) The impact of heat transfer enhancement techniques on energy savings in the US industry.** Rebello, W.J.; Peterson, G.R.; Sohal, M. (EG and G Idaho, Inc., Idaho Falls (USA)). 1988. Contract AC07-76ID01570. 8p. (CONF-880982—2). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005184/JAW.

From 10. annual industrial energy technology conference; Houston, TX, USA (13 Sep 1988).

Since the mid-seventies, the manufacturing industries' trend towards energy conservation has spurred both heat exchanger makers and users to try novel techniques for heat transfer enhancement. Augmentation techniques, applied to the fluids that have the major thermal resistance, can increase the overall heat exchanger. Enhancement techniques can also be used to upgrade the capacity of an existing heat exchanger, to reduce the approach temperature difference between two process streams, thereby conserving energy in the process and to reduce pumping power, thereby reducing operating costs. This paper attempts to quantify the impact of enhancement on energy savings and capital costs. The overall heat exchanger market was divided into four sectors: the chemical, petroleum, electrical utility and other industries. The total US sales of all industrial heat exchangers, except boilers and automotive radiators, was approximately $1.6 billion (about 285,000 units) in 1982. About 59% of the total represented liquid-to-liquid shell and tube heat exchangers, and this is where the biggest impact from heat transfer enhancement can be made. If enhancement techniques were implemented throughout the industries considered in this study, the maximum potential energy savings, i.e., less energy used from the hot utility or less energy discarded to the cold utility because of superior heat transfer in the heat exchangers, could amount to about 2.5 Quad. Alternately, if one were to consider the reduction in heat exchanger surface area requirements for a given heat duty because of enhanced heat transfer, the capital cost savings would amount to 350 million annually. Research recommendations in enhanced heat transfer include the development of cost effective manufacturing techniques for ceramic and metal construction materials and investigations into the effects of heat transfer enhancement on fouling and corrosion. 19 refs., 2 tabs.

10962 **(EGG-M—39187) The cost of heat exchanger fouling in the US industries.** Rebello, W.J.; Richlen, S.L.; Childs, F. (EG and G Idaho, Inc., Idaho Falls (USA)). 1988. Contract AC07-76ID01570. 8p. (CONF-880982—3). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005179/JAW.

From 10. annual industrial energy technology conference; Houston, TX, USA (13 Sep 1988).

Fouling of heat exchangers costs the US industries hundreds of millions of dollars every year in increased equipment costs, maintenance costs, energy losses and losses in production. The designer of heat exchangers usually allows for fouling by using a fouling factor in the design which results in additional capital cost of the heat exchanger. As fouling deposits build up in a heat exchanger, its performance will start to deteriorate and less energy will be transferred through the unit. A plot is provided that gives the percent decrease in heat flux, for a constant driving temperature difference, as a function of the clean overall heat transfer coefficient and the fouling factor. Another plot gives the increase in surface area due to fouling for the same heat transfer rate and driving temperature difference, as a function of the clean overall heat transfer coefficient and the fouling factor. The overall heat transfer market was divided into four sectors: the chemical, petroleum, electric utility and other industries. The 1982 US sales of all industrial heat exchangers, excepting boilers and automotive radiators, was about 285,000 units amounting to about $1.6 billion. The total heat duty of all the heat exchangers in industrial operation, including electric utilities, was estimated at 11.7 Quads. If this represented the amount of heat transferred through clean heat exchangers, the decrease in energy transferred due to fouling or the cost of fouling in terms of energy lost was estimated at 2.9 Quads annually. The cost of fouling, in providing for additional surface area to compensate for a decrease in heat transfer, was conservatively estimated at $180 million in 1982. 12 refs., 2 figs., 5 tabs.

10963 **(EPRI-AP—5975) Soft-start fuel control modifications for large, heavy-duty combustion turbines: Final report.** Brawley, G.H. (ed.). (Electric Power Research Inst., Palo Alto, CA (USA); Battelle Columbus Div., OH (USA)). Oct 1988. 116p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI89002759/JAW.

Gas turbine start-up and shutdown causes thermal transients that stress the hot gas path parts and reduce their low-cycle fatigue (LCF) life. Experience has shown that combustion system degradation is more extensive on combustion turbines that have frequent starts and shutdowns than on continuously operating machines. The start-up schedules of many machines are designed to minimize the amount of time to reach full load. Many gas turbine users do not have that need and could tolerate alternative start-up schedules. Experiments were performed on a prevalent gas turbine (General Electric MS7001B) and its control system (SPEEDTRONIC Mark I) burning natural gas at the T.H. Wharton Plant of Houston Lighting and Power Company (HL&P). The results were used to determine fuel control settings for the control system. Specific findings are given related to improved fuel settings for quicker ignition, gradual initial warm-up, a lower acceleration Soft Start, and lower deceleration Fired Shutdown. Additionally, a new setting for the minimum fuel required during operation with water injection for NO/sub x/ control were found. The normal start-up sequence of the gas turbine is described and illustrated to aid in the understanding of the experiments and results and to allow a user to extend the results to other gas turbines and control systems. 28 figs., 5 tabs.

10964 **(EPRI-AP—6020) Using optical pyrometry to measure gas turbine blade metal temperatures: Final report.** Lindsey, O.L. (Electric Power Research Inst., Palo Alto, CA (USA); Solar Turbines, Inc., San Diego, CA (USA)). Dec 1988. 233p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI89004853/JAW.

This report presents the experience gained by field testing an infrared optical pyrometer as a Turbine Blade Temperature Measurement System (TBTMS). This system was designed, built, and tested to make diagnostic measurements on an operating gas turbine at the T.H. Wharton Station of Houston Lighting and Power. The TBTMS is comprised of a probe assembly, an optical conduit, a detector, and a signal processor. The system senses thermal radiation from the turbine blades and transforms that signal into a real time value indicating the blade metal surface temperature. The information supplied by the TBTMS was recorded by a data acquisition system that also gathered information about the operation and performance of the engine. The information from the TBTMS was correlated with the critical operating parameters of the engine over a span of approximately 7000 hours. Initial performance of the TBTMS was satisfactory, and the configuration proved reasonably durable, demonstrating the value of such a probe for diagnosing engine conditions. Most notably, the pyrometer detected several blades that were consistently hotter than adjacent blades; such conditions could lead to shorter blade life. The report discusses blade temperature profiles and math models for predicting the durability of the blades. Recommendations were included which addressed design improvements for future TBTMS. 56 figs.

10965 **(NEI-DK—109) Experiment with straw fueling at Masnedoe power station 1985-1987.** (Seas, Haslev (Denmark)). Mar 1988. 59p. (In Danish). NTIS (US Sales Only), PC A04. Order Number DE88755790/JAW.

The partial stoking with straw of a boiler that is normally fueled exclusively with coal dust, is presented as being a new initiative. An experiment was carried out, over a period of two years, at Masnedoe power station, where it was found necessary to construct two slow-working slicing systems in connection with the stoking apparatus. Fueling with 2x2 tons of straw/h, replacing a total of 2.3 tons coal dust fuel/h, producing 5.6 MW of electric power based on straw fueling, was the calculation basis. It was generally concluded that straw slicing gave rise to operational problems necessitating increased manpower and that the stoking systems were as yet unsatisfactory. The increase of necessary manpower, maintenance expenses and discrepancies in straw and coal prices made for unacceptable operational prices. The machinal installations are described, and operational data are illustrated with the help of tables. (AB).

10966 **(NEI-FI—44) Utilization of waste heat in Haapavesi condensing power plant. Preliminary study.** Kalmari, A.; Leino, P. (Ekono, Helsinki (Finland)). Dec 1987. 60p. (In Finnish). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88755807/JAW.

This preliminary study describes different alternatives of the utilization of waste heat in the Haapavesi condensing power plant. The waste heat power plant which comes from the condensor is about 200 MW. The cooling water stream is 6.3 m/sup 3//s and the rise of the water temperature is 7.5 deg C. This means that there is water with the temperature of 7.5 deg C to 18 deg C in the cooling water channel during the period when the power plant is in operation. The aim has been to find out as many users as possible of the low-tempered water. Different industrial, agricultural and aquacultural users have been studied. There is also a brief study on the costs of raising the temperature with the help of a heatpump. It is economic to use a heatpump only when the water temperature is raised to maximum 30 deg C. The other economic way to use a heatpump in Haapavesi is to find a need of cooling. If the heatpump were economic, there would be a lot of more potential users of waste heat. The only realistic alternatives in Haapavesi are aquaculture and soil warming. In aquaculture the production of fishfry is recommended be cause of its smaller environmental impact of the basin. The most recommendable alternative in Haapavesi is, however, soil warming. The growing period could be lenthtened and because of the warmwater pipes some frost enduring plants could be planted earlier than usual. This means that these plants come earlier to the market and can be sold with a higher profit. The annual costs for the soil warming are about 120 000 FIM/ha, a. The income is estimated to be 100 000 - 500 000 FIM/ha,a which means that there are good reasons in Haapavesi for utilization of waste heat in soil warming.

10967 **(SV-UG—1988-10) Combined heat and power production with natural gas.** Svensson, B. (Swedish State Power Board, Vaellingby). 21 Dec 1987. 140p. (In Swedish). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88755912/JAW.

The subject of this report is the technology of combined production of heat and power with natural gas. A general description is made of the technology, with the purpose to briefly cover all main aspects. The following subjects are discussed: basic conditions, system lay-outs, component and plant design, environmental aspects (mainly emission) and equipment offered by a number of manufacturers. The description covers the following systems: back pressure steamturbine plant, gasturbine with heat recovery boiler, combined cycle and gasengine with heat recovery boiler. Interest in focused on the three last system types. Possible applications for natural gas fired cogeneration in Sweden, in industry and for local and district heating, are discussed. Economic background data such as investment cost, operation and maintenance cost and performance figures are presented. Using these data, and an assumption for the price of natural gas and the value of produced heat, a calculation of the electricity production cost (excluding tax) is made. Different types and sizes of plants in the range 1-200 MW are studied.

2002 Environmental Control Technology

REFER ALSO TO CITATION(S) 10646, 10647, 10648, 10649, 10653

10968 **(DOE/EA—0375) [Bradfield Electric and Alaska Power Authority Presidential permit]: Finding of no significant impact (FONSI).** (USDOE Economic Regulatory Administration, Washington, DC). [1988]. 47p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005360/JAW.

The Economic Regulatory Administration (ERA) of the Department of Energy (DOE) is considering an application by Bradfield Electric, Inc. (Bradfield), and the Alaska Power Authority (APA) for a Presidential permit to construct, operate, maintain and connect a 69-kilovolt (kV) transmission line which would extend from the APA's Tyee Lake Hydroelectric Power Project located near Wrangell, Alaska, to a point on the US-Canadian international border just east of the South Fork Craig River. The DOE has reviewed an environmental assessment (EA) prepared by the US Forest Service (USFS) in connection with its issuance of a special use permit to construct the proposed line through the Tongass National Forest. Based on this EA, the USFS issued a decision notice and a finding of no significant impact (FONSI) for the proposed project on May 9, 1988. The DOE is adopting this EA as DOE/EA-0375 in partial satisfaction of its responsibilities under the National Environmental Policy Act of 1969 (NEPA) regarding the issuance of a Presidential permit.

10969 **(DOE/PC/91024—T9) Characterization and fundamental studies on CuO sorbent materials to determine attrition mechanisms on substrate gamma alumina: Technical progress report No. 8 for the period June 23, 1988--September 23, 1988.** Mote, J.D.; Eucker, P.; Naziripour, A.; Zillman, W. (Denver Univ., CO (USA). Dept. of Engineering). 1988. Contract AC22-86PC91024. 6p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005009/JAW.

In this quarterly report, preliminary data of the two main factors contributing to the attrition of sorbent alumina spheres, namely fatigue and temperature effects, are reported. This data is useful for determining the relationship between the rate of attrition and mechanical strength and will serve as a guide for measuring the efficacy of methods designed to strengthen the sorbent. The initial efforts to modify the structure by heat treatment are still being evaluated. 2 figs.

10970 **(Juel—2172) New waste disposal problems in coal-fired power plant.** Hoevelmann, A. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Programmgruppe Systemforschung und Technologische Entwicklung; Technische Hochschule Aachen (Germany, F.R.)). Dec 1987. 114p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88756195/JAW.

This study aimed at the quantitative evaluation of new disposal problems of coal-fired power stations arising from the introduction of wet flue gas desulphurization technology. The natural radionuclides which are brought into the system by coal and adsorbents, served as indicators for the environmental compatibility. They are discharged with the mass flows (gypsum, waste water, sludge) from the flue gas desulphurization plant and contaminate them with radioactivity. For a practice-oriented presentation of the problem, the calculations refer to a power station size which is used more and more for the generation of current by coal combustion: The 750 MW hard coal unit.

10971 **(NEI-DK—102) Wet processes for the elimination of nitrogen oxides.** Nielsen, P.R.; Skov, S. (DK-Teknik, Soeborg (Denmark)). Jun 1988. 33p. (In Danish). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755785/JAW.

The relevant litterature has been studied to discover if any wet processes for removal of NOx from fluegas have reached a state of development that would make them useful alternatives to the SCR-proces. The processes studied are the EDTA-complex reduction method by SHL, the oxidation/absorption process by

Walther, and the sulfuric and nitric acid producing process by Ciba-Geigy. The study has shown that no wet processes were available for practical use, and this was confirmed by two of the companies, Lurgi GmbH and Krupp Koppers GmbH, who have been involved in the development of wet processes for NOx-removal. For the time being the companies mentioned have stopped developing the processes as they seem neither technically, nor economically, competitive to the SCR-process. It is to be anticipated that the SCR-process will be the most widely used method for NOx-removal in the years to come. 31 refs. (AB).

10972 **(PB—89-120737/XAB) Relationship between the mass concentration and light attenuation of particulate emissions from coal-fired power plants (journal version).** Conner, W.D.; Knapp, K.T. (Environmental Protection Agency, Research Triangle Park, NC (USA). Atmospheric Sciences Research Lab.). 1988. 9p. (EPA—600/J-88/162). NTIS, PC A02/MF A01.

Pub. in Jnl. of the Air Pollution Control Association 38, 152-157(1988).

Data are presented on 40 mass concentration-light attenuation tests of particulate emissions at coal-fired power plants with electrostatic precipitator controls, and on particle-size measurements at two plants near the high and low extremes in the range of the mass concentration-light-attenuation tests. Good correlations were observed between mass concentration and light attenuation measurements at most of the plants. Ninety-three % of the tests had correlation coefficients of 0.90 or better. Unfortunately, the relationship varied considerably from plant to plant. A theoretical analysis of the light attenuation to mass concentration ratio from the particle size measurements at the plants near the range extremes accounted for about half of the measured range. The repeatability of several mass concentration-light attenuation tests at the same plants at different times was inconsistent; however, a more accurate monitoring of the mass concentration is obtained if an empirically established mass concentration-light attenuation relationship is used to calibrate the transmissometer for the plant.

10973 **(PSU-ME-R—86-87-0031) Acoustic agglomeration of power plant fly ash: Quarterly technical report, 5 November 1986--5 February 1987.** Reethof, G. (Pennsylvania State Univ., University Park (USA). Noise Control Lab.). 20 Mar 1987. Contract AC22-86PC91022. 69p. NTIS, PC A04/MF A01 - OSTI. Order Number DE89003692/JAW.

High-intensity, high-efficiency sound sources are needed for acoustic agglomeration of particle-laden aerosols in power plant flues and for combustion enhancement. The theory of the linear model is reviewed and show to be in strong disagreement with experimental results. A theoretical study of the sound generation mechanism in sirens is then presented. The various sound attenuation mechanisms are reviewed and a low frequency numerical solution for the frequency response is given which includes arbitrary attenuation, dispersion, horn shape, and mean flow. Next finite-amplitude sound propagation in a horn is studied. Results are presented that agree very well with experimental data. Important nonlinear phenomena such as shock formation, acoustic saturation, and distortion of initially non-sinusoidal finite- amplitude waves are discussed. Finally, a new siren design methodology is presented, including a step-by-step discussion on hot to minimize the acoustic losses. 8 figs.

2003 Power Transmission And Distribution

10974 **(AD-A—199675/0/XAB) Intelligent load manager (LOADMAN): application of expert-system technology to load-management problems in power generation and distribution systems. Phase 1. Final report, December 1987-31 August 1988.** (Technology Applications, Inc., Jacksonville, FL (USA)). 10 Aug 1988. 53p. (TAI-AL—60608-FR). NTIS, PC A04/MF A01.

Domain analysis and the development of the rapid prototype system have revealed that the implementation of an expert system is possible if some preliminary work is done to standardize the equipment and establish clear guidelines for load shedding and other decisions. This effort should be carried out (even if the expert system is not implemented) to ensure reliable, efficient power generation and utilization and to reduce the likelihood of costly mistakes. The contractor is convinced that the technology is valuable to the Army in terms of improved inventory handling, optimized power usage, and operator training, all leading to more-effective mission completion.

10975 **(ECRC/M—2312) Some aspects of water treeing in cross-linked polyethylene insulation.** Naybour, R.D. (Electricity Council Research Centre, Capenhurst (UK)). Oct 1988. 5p. Available from: Electricity Council Research Centre, Capenhurst, Chester, CH1 6ES, UK.

The factors influencing water tree growth in cross-linked polyethylene (XLPE) cables have been investigated, particularly the role of heat treatment prior to water tree growth and the influence of water trees on the breakdown strength. The report concludes that heat treatment of XLPE can increase the incidence of bow-tie water trees but that heating at the melting temperature has no marked influence. It is suggested that the presence of voids tends to reduce the number of growth sites for bow-tie water trees. Water trees reduce the breakdown strength by acting as sources of field enhancement, and heat treatment to 120 C for 24 hours does not significantly reduce the deteriorating effects of water trees.

10976 **(ECRC/R—2305) Overview of condition monitoring of 11 kV oil circuit-breakers with the Capenhurst current counter.** Aubrey, D.R. (Electricity Council Research Centre, Capenhurst (UK)). Nov 1988. 32p. Available from: Electricity Council Research Centre, Capenhurst, Chester, CH1 6ES, UK.

The Capenhurst current counter was designed to monitor the operations of auto-reclosing 11 kV oil circuit-breakers within the UK Electricity Supply Industry. It is a panel-mounted measurement and control unit which is connected into the current transformer and trip-coil circuits of an oil circuit-breaker, so to provide a continuous indication of the internal condition of the circuit-breaker. This report describes the design, calibration, installation and use of the current counter. The results of a field trial are described. It is suggested that the current counter will provide valuable assistance with the maintenance planning of heavily used 11 kV oil circuit-breakers, and that the current counter can be the hingepin for very sound maintenance methods and circuit-breaker utilisation.

10977 **(EFI-TR—3355) Storing in the distribution network.** Sandbakken, S.; Livik, K. (Energidata A/S, Trondheim (Norway)). (Elektrisitetsforsyningens Forskningsinstitutt, Trondheim (Norway)). Oct 1986. 52p. (In Norwegian). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88755765/JAW.

The report describes a subject analysis on the storing conditions in the Norwegian power distribution network. The analysis is based on the comprehensive load measurements done in the period from 1980 to 1985, and the various storing conditions are described. For the household sector concerned, the Velander constants are calculated, and the variance in relation to the Velander equation is described. For the service sector concerned, the variation of the user time in relation to the annual consumption is described. 27 figures, 15 tables.

10978 **(EFI-TR—3441) Improved utilization of the distribution network. Voltage amplification and automatic sectioning.** Finnset, T. (Elektrisitetsforsyningens Forskningsinstitutt, Trondheim (Norway)). Aug 1987. 57p. (In Norwegian). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88755766/JAW.

The report concerns the high voltage network, and discusses the use of cost beneficial methods to improve its utilization. The methods of voltage amplification and automatic sectioning are discussed. The methods and strategy for the voltage amplification together with the use of automatic sectioning by faults in the network are described. The report also describes the various types of faults, fault determination, control systems, and a system for the execution of the automatic sectioning. 7 figures, 1 table.

10979 **(EPRI-EL—6106) DCGRND and ACDCFLT computer models and user's manuals: Interim report.** Meliopoulos, A.P.S.; Christoforidis, G. (Electric Power Research Inst., Palo Alto, CA (USA); Georgia Inst. of Tech., Atlanta (USA). Electric Power Lab.). Dec 1988. 130p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI89005536/JAW.

Most dc transmission systems are designed with a dc ground electrode which stabilizes dc voltages and provides an alternate return path (ground) during emergency conditions. The design of dc ground electrodes is dictated by several factors, such as (1) expected useful life, (2) safety, (3) minimum interaction with the ac system, etc. To what degree a specific dc ground electrode satisfies design factors can be determined with analysis models which predict the maximum ground potential rise of the dc ground, the maximum current density at the surface of the ground anode assemblies and the transfer voltage to substation safety grounding system. A computer based analysis model which is useful in the design of a dc ground electrode has been developed. Specifically, a new method and a computer model with the name DCGRND has been developed which determines the electric current distribution in a dc ground electrode system. This analysis yields the following information: (1) total resistance to remote earth, (2) step voltages, (3) transfer voltages, and (4) electric current density along the ground electrodes. In addition to this, another method and a computer model with the name ACDCFLT have been developed which models the entire converter station for the purpose of computing electric current distribution during normal or fault conditions on the ac or dc side. This computer model yields the maximum ground potential rise of the station ground, as well as the dc ground and the dc current injected into earth. This report describes the analysis methods and includes a users manual of the two computer models. The two computer models are useful tools in the design of dc ground electrode systems. 47 figs., 27 tabs.

10980 **Lightning location system for the UK electricity supply industry.** Scott, L. Capenhurst, England; Electricity Council Research Centre (1988). 5p. NTIS, PC A23/MF A01.

A short history is given of the development of a lightning location system based on a network of direction finding stations. The system makes use of the earth-ionosphere waveguide to greatly reduce the effect of anomalous waves on bearing accuracy. An improved direction finding loop antenna is described. Details of the system performance are given.

21 NUCLEAR POWER PLANTS

REFER ALSO TO CITATION(S) 11070, 12462

10981 **(INIS-mf—11268) Bhabha Atomic Research Centre: annual report 1986-87.** (Bhabha Atomic Research Centre, Bombay (India)). 1987. 96p. NTIS (US Sales Only), PC A05/MF A01. Order Number DE88704146/JAW.

The Research and Development (R and D) work and achievements of the Bhabha Atomic Research Centre, Bombay, during the financial year 1986-1987 are reported. The R and D activities of BARC cover the entire nuclear fuel cycle, production and use of radioisotopes, radiation protection and also basic research in several disciplines. The report is presented in the chapters entitled: Physical Sciences, Chemical Sciences, Materials and Materials Science, Life Sciences, Radioisotopes, Reactors, Fuel Cycle, Health and Safety, Electronics and Instrumentation, Engineering and General Services. At the end of each chapter are listed the journal articles published, the paper presented at conferences, symposia etc. and technical reports issued by the scientists of BARC in the subject field indicated by the title of the chapter. The R and D work of the outstation units of BARC, namely, Nuclear Research Laboratory at Srinagar, High Altitute Research Laboratory at Gulmarg, Variable Energy Cyclotron Centre at Calcutta and Gauribidanur Seismic Array near Bangalore are also described in the report. The report concludes with a brief account of: (1) transfer of technologies developed at the Centre, (2) activities related to human resource development for nuclear programmes of the country, and (3) progress of design and construction work of Centre for Advanced Technology at Indore. (M.G.B.).

10982 **(INIS-mf—11269) BARC highlights 86.** (Bhabha Atomic Research Centre, Bombay (India)). 1987. 126p. NTIS (US Sales Only), PC A07/MF A01. Order Number DE88704147/JAW.

The Bhabha Atomic Research Centre (BARC), Bombay, is the premier multidisciplinary research establishment of the Department of Atomic Energy (India). It provides Research and Development (R and D) support to the nuclear programmes of the country. Some of its important R and D activities and achievements during 1986 are described in brief in the chapters entitled: Physical Sciences, Chemical Sciences, Materials and Materials Sciences, Life Sciences, Reactors, Fuel Cycle, and Electronics and Instrumentation. The entire text is illustrated with a number of diagrams and photographs. (M.G.B.).

10983 **(NUREG—0540-Vol.10-No.9) Title list of documents made publicly available: September 1--30, 1988.** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Administration and Resources Management). Nov 1988. 360p. NTIS, PC A17 - GPO - OSTI. Order Number TI89004448/JAW.

This document is a monthly publication containing descriptions of information received and generated by the US Nuclear Regulatory Commission (NRC). This information includes (1) docketed material associated with civilian nuclear power plants and other uses of radioactive materials, and (2) nondocketed material received and generated by NRC pertinent to its role as a regulatory agency. The following indexes are included: Personal Author, Corporate Source, Report Number, and Cross Reference to Principal Documents.

2101 Power Reactors, Non-breeding, Light-water Moderated, Boiling Water Cooled

REFER ALSO TO CITATION(S) 11013, 11023, 11069, 11072, 11074, 11075, 11076, 11077, 11078, 11081, 11083, 11088, 11090, 11092, 11093, 11094, 11102, 11104, 11106, 11108, 11109, 11110, 11113, 11118, 11119, 11127, 11133, 11135, 11137

10984 **(CONF-8810155—25) Environmentally assisted cracking in light water reactors.** Shack, W.J.; Kassner, T.F.; Maiya, P.S.; Park, J.Y.; Ruther, W.E. (Argonne National Lab., IL (USA)). Oct 1988. Contract W-31109-ENG-38. 29p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004204/JAW.

From 16. water reactor safety information meeting; Gaithersburg, MD, USA (24 Oct 1988).

Research during the past year focused on (1) stress corrosion cracking (SCC) of austentitic stainless steels (SS), (2) fatigue of Type 316NG SS, and (3) SCC of ferritic steels used in reactor piping, pressure vessels, and steam generators. Stress corrosion cracking studies on austentitic SS explored the critical strains required for crack initiation, the effects of crevice conditions on SCC susceptibility, heat-to-heat variations in SCC susceptibility of Type 316NG and modified Type 347 SS, the effect of heat treatment on the susceptibility of Type 347 SS, threshold stress intensity values for crack growth in Type 316NG SS, and the effects of cuprous ion and several organic salts on the SCC of sensitized Type 304 SS. Crevice conditions were observed to strongly promote SCC. Significant heat-to-heat variations were observed in SCC susceptibility of Types 316NG and 347 SS. No correlation was found between SCC behavior and minor variations in chemical composition. A significant effect of heat treatment was observed in Type 347 SS. A heat that was extremely resistant to SCC after heat treatment at 650{degree}C for 24 h was susceptible to transgranular stress corrosion cracking (TGSCC) in the solution-annealed condition. Although there was no sensitization in either condition, the presence or absence of precipitates and differences in precipitate morphology appear to influence the SCC behavior. 20 refs., 20 figs., 11 tabs.

10985 **(EPRI-NP—6082) Intraspect/98 characterization of a heavy section.** Zhang, Y.; Smith, B. (Electric Power Research Inst., Palo Alto, CA (USA); AMDATA, Inc., Milpitas, CA (USA)). Nov 1988. 141p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI89004098/JAW.

In support of the effort to maximize safety in nuclear power plants, Amdata, Inc., (under EPRI Contract RP 2165-08) conducted a study to determine the feasibility of utilizing the Amdata Intra-Spect/98 (I/98) Ultrasonic Imaging System to inspect reactor pressure vessels. The I/98 was used to perform a full volumetric examination on a section of a low-alloy steel pressure vessel supplied by Westinghouse Electric Corporation. This specimen is reported to be typical of pressure vessels used in commercial pressurized water reactor plants. The test specimen measures 55 inches in diameter by 10.5 inches thick, weighs 7000 pounds, and has a stainless-steel clad weld along the full diameter. The volume inspected includes 36 inches along the length of the weld, 10 inches on each side of the weld centerline, and the entire 10.5 inch thickness. For the inspection, three ultrasonic transducers were mounted on a wheeled sled and positioned at three different angles (60 and 45 degrees shear wave, and 0 degree longitudinal wave). They were immersed in water to simulate the conditions of an actual inspection of a reactor pressure vessel. The test results show that the I/98 successfully inspected the Westinghouse specimen and is capable of successfully inspecting similar reactor pressure vessels. 31 figs., 2 tabs.

10986 **(EPRI-NP—6103-CCM-Vol.3) The stability analysis using two fluids (SAT{trademark}) code for boiling flow systems: Volume 3: User's manual.** Roy, R.P.; Dykhuizen, R.C.; Su, M.G.; Jain, P. (Electric Power Research Inst., Palo Alto, CA (USA); Arizona State Univ., Tempe (USA). Dept. of Mechanical and Aerospace Engineering). Dec 1988. 57p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI89004486/JAW.

This report presents analyses of dynamic instability and frequency response characteristics of boiling flow systems based on an unequal velocity, unequal temperature two-fluid model of such flow. The dynamic instability analyses in the time domain are incorporated into three options of a computer code SAT, viz., DI01 (steady state, or equilibrium point analysis), DI02 (linear stability analysis in time domain), and DI03 (nonlinear analysis in time domain). The frequency response analysis is incorporated into a fourth option FREQ. Results of dynamic instability experiments carried out in a Refrigerant-113 boiling flow rig are also reported as are comparison of these with linear stability analysis predictions. A description of the input file structure of the four codes is present in this volume of the report. Outputs of these codes are also described in detail. Sample input and output files are included in the appendices of this volume.

10987 **(NUREG/CR—5171) Flow visualization study of post critical heat flux region for inverted bubbly, slug and annular flow regimes.** Denten, J.G.; Ishii, M. (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Systems Research; Argonne National Lab., IL (USA)). Nov 1988. Contract W-31109-ENG-38. 83p. (ANL—88-27). NTIS, PC A05/MF A01 - GPO - OSTI. Order Number TI89004068/JAW.

A visual study of film boiling using still photographic and high- speed motion picture methods was carried out in order to analyze the post-CHF hydrodynamics for steady-state inlet pre-CHF two-phase flow regimes. Pre-CHF two-phase flow regimes were established by introducing Freon 113 liquid and nitrogen gas into a jet core injection nozzle. An idealized, post-CHF two-phase core initial flow geometry (cylindrical multiphase jet core surrounded by a coaxial annulus of gas) was established at the nozzle exit by introducing nitrogen gas into the annular gap between the jet nozzle two-phase effluent and the heated test section inlet. For the present study three basic post-CHF flow regimes have been observed: the rough wavy regime (inverted annular flow preliminary break down), the agitated regime (transition between inverted annular and dispersed droplet flow), and the dispersed ligament/droplet regime. For pre-CHF bubbly flow in the jet nozzle, the post-CHF flow (beginning from jet nozzle exit/heated test section inlet) consists of the rough wavy regime, followed by the agitated and then the dispersed ligament/droplet regime. In the same way, for pre-CHF slug flow in the jet core, the post-CHF flow is comprised of the agitated regime at the nozzle exit, followed by the dispersed regime. Pre-CHF annular jet core flow results in a small, depleted post-CHF agitated flow regime at the nozzle exit, immediately followed by the dispersed ligament/droplet regime. Observed post dryout hydrodynamic behavior is reported, with particular attention given to the transition flow pattern between inverted annular and dispersed droplet flow. 43 refs., 20 figs., 5 tabs.

10988 **(ORNL/TM—10901) A classification scheme for LWR fuel assemblies.** Moore, R.S.; Williamson, D.A.; Notz, K.J. (Oak Ridge National Lab., TN (USA)). Nov 1988. Contract AC05-84OR21400. 127p. NTIS, PC A06/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005688/JAW.

With over 100 light water nuclear reactors operating nationwide, representing designs by four primary vendors, and with reload fuel manufactured by these vendors and additional suppliers, a wide variety of fuel assembly types are in existence. At Oak Ridge National Laboratory, both the Systems Integration Program and the Characteristics Data Base project required a classification scheme for these fuels. This scheme can be applied to other areas and is expected to be of value to many Office of Civilian Radioactive Waste Management programs. To develop the classification scheme, extensive information on the fuel assemblies that have been and are being manufactured by the various nuclear fuel vendors was compiled, reviewed, and evaluated. It was determined that it is possible to characterize assemblies in a systematic manner, using a combination of physical factors. A two-stage scheme was developed consisting of 79 assembly types, which are grouped into 22 assembly classes. The assembly classes are determined by the general design of the reactor cores in which the assemblies are, or were, used. The general BWR and PWR classes are divided differently but both are based on reactor core configuration. 2 refs., 15 tabs.

10989 **(PSI—2) Activity build-up on the circulation loops of boiling water reactors: Basics for modelling of transport and deposition processes.** Covelli, B.; Alder, H.P. (Tecova A.G., Wohlen (Switzerland); Paul Scherrer Institut, Labor fuer Werkstoffe und nukleare Verfahren, Wuerenlingen (Switzerland)). (Paul Scherrer Inst. (PSI), Wuerenlingen (Switzerland). Lab. fuer Werkstoffe und Nukleare Verfahren). Mar 1988. 48p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704161/JAW.

In the past 20 years the radiation field of nuclear power plant loops outside the core zone was the object of investigations in many countries. In this context test loops were built and basic research done. At our Institute PSI the installation of a LWR-contamination loop is planned for this year. This experimental loop has the purpose to investigate the complex phenomena of activity deposition from the primary fluid of reactor plants and to formulate analytical models. From the literature the following conclusions can be drawn: The principal correlations of the activity build-up outside the core are known. The plant specific single phenomena as corrosion, crud-transport, activation and deposit of cobalt in the oxide layer are complex and only partially understood. The operational experience of particular plants with low contaminated loops (BWR-recirculation loops) show that in principle the problem is manageable. The reduction of the activity build-up in older plants necessitates a combination of measures to modify the crud balance in the primary circuit. In parallel to the experimental work several simulation models in the form of computer programs were developed. These models have the common feature that they are based on mass balances, in which the exchange of materials and the sedimentation processes are described by global empirical transport coefficients. These models yield satisfactory results and allow parameter studies; the application however is restricted to the particular installation. All programs lack models that describe the thermodynamic and hydrodynamic mechanisms on the surface of deposition layers. Analytical investigations on fouling of process equipment led to models that are also applicable to the activity build-up in reactor loops. Therefore it seems appropriate to combine the nuclear simulation models with the fundamental equations for deposition. 10 refs., 18 figs., 3 tabs.

2102 Power Reactors, Non-breeding, Light-water Moderated, Non-boiling Water Cooled

REFER ALSO TO CITATION(S) 10790, 10984, 10985, 10987, 11013, 11071, 11076, 11081, 11087, 11091, 11095, 11096, 11097, 11100, 11101, 11103, 11105, 11107, 11111, 11112, 11114, 11115, 11116, 11119, 11127, 11129, 11130, 11131, 11132, 11133, 11135, 11349, 12331

10990 (CNIC—000123) Transient stress analysis of PWR pressure vessel. Xu Dinggeng; Wang Baisong. (Shanghai Nuclear Engineering Research and Development Inst. (China)). (China Nuclear Information Centre, Beijing, BJ). 1987. 11p. (In Chinese). (NERDI—0004). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704107/JAW.

Under design transients, such as heat-up, operation and cooling-down, the transient temperature and stress field in the reactor pressure vessel involving its nozzle junctions are caused by temperature and pressure of coolant, internal heat generation, bolt load and nozzle loads. In this paper the axisymmetrical and three dimentions finite element methods are used for analysing these temperature and stress field. The results show that the stress field in nozzle junction is important and the thermal stresses resulting from two-dimension distribution of internal heat generation which is caused by γ-ray are almost limited in activity area and its maximum stress is less than other stresses in one or two order of magnitudes.

10991 (CONF-8810155—23) Shippingport aging studies: Results and plans. Shack, W.J.; Chopra, O.K.; Chung, H.M. (Argonne National Lab., IL (USA)). Oct 1988. Contract W-31109-ENG-38. 29p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89003632/JAW.

From 16. water reactor safety information meeting; Gaithersburg, MD, USA (24 Oct 1988).

The objective of this program is to develop an understanding of the metallurgical phenomena that may occur in nuclear reactor structural materials as a consequence of extended service at operating temperatures within and outside of the radiation environment and to assess the impact of these phenomena on structural integrity. Although many aging phenomena such as the embrittlement of cast stainless steel, low-temperature sensitization of austenitic stainless steels, and radiation embrittlement of pressure vessel steels have been studied in the laboratory, most of the studies have been based on simulation of actual reactor conditions. The Shippingport reactor offers a unique opportunity to validate and benchmark the laboratory studies, and thereby, provide a sound basis for evaluating the integrity of structural components near the end of the projected life of the plant. Additional work will be undertaken to identify the possibility of new, previously unknown mechanisms of component degradation. 6 refs., 10 figs., 6 tabs.

10992 (EPRI-NP—6084) Cost of converting to an all-ferrous PWR secondary feedwater system. Siegwarth, D.P.; Chakravorti, R.K. (Electric Power Research Inst., Palo Alto, CA (USA); NWT Corp., San Jose, CA (USA); Gibbs and Hill, Inc., San Jose, CA (USA)). Oct 1988. 23p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI89004292/JAW.

Steam generators and turbines in pressurized water reactor plants have experienced a variety of corrosion problems as a result of ionic, corrosion product and oxidizing species transport into the steam generators. Copper and nickel oxide from the corrosion of feedwater train and reheater copper alloy tubes are particularly aggressive steam generator corrodants. Transport of these aggressive oxides can be reduced by replacing copper alloy heat exchanger tubes with all ferrous alloys. The required changes and associated costs for replacing the copper alloy heat exchanger tubes are given. 6 refs., 1 fig., 1 tab.

10993 (EPRI-NP—6097) Solids filtration of high-temperature feedwater in a PWR secondary circuit: Final report. Siegwarth, D.P.; Friedman, K.A.; Chakravorti, R.K.; Alibutod, L.J. (Electric Power Research Inst., Palo Alto, CA (USA); NWT Corp., San Jose, CA (USA); Gibbs and Hill, Inc., San Jose, CA (USA)). Nov 1988. 50p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI89004293/JAW.

Pressurized water reactor steam generators and turbines have experienced a variety of corrosion problems as a result of ionic, corrosion product and oxidizing species transport to the steam generators. Installation of high temperature filters on final feedwater, high pressure drains and moisture separator drains to reduce corrosion product ingress to the steam generators of a 1160 MWe design basis plant are specified and evaluated. Cost estimates for installing electromagnetic filters, and added operating and maintenance costs are given. 18 refs., 12 figs., 9 tabs.

10994 (KFK—4461) Qualification of the JEF-1 nuclear data library for pressurized water reactor burnup analysis. Mateeva, A. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Neutronenphysik und Reaktortechnik; Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Projekt Wiederaufarbeitung und Abfailbehandlung). Jan 1988. 35p. (PWA—46/88). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756391/JAW.

The Joint Evaluated File JEF-1 is used as a basis to generate group constants for fuel cycle analyses for PWRs. This group constant set is applied to the NEACRP-benchmark on 'Recycling of Reprocessed Uranium' and to postirradiation experiments in the KWO/PWR. The results in k/sub 00/ for the NEACRP-benchmark almost coincide with the average of the solutions submitted to the benchmark. The calculated end-of-life (EOL) nuclide concentrations are in good agreement with experimental results obtained for a KWO/PWR configuration with the exception of the EOL concentration of Cm-242; a careful check shows that very probably the experimental values are too low; this conclusion is consistent with the overall findings. As another example, JEF-1 nuclear data are used to analyse a tight lattice configuration of advanced PWRs (APWR). A special aspect is addressed in this paper, i.e. the reliable determination of the reactivity change upon voiding a tight lattice. It is shown that the use of consistent weighting spectra for the normal (water-in) and the voided (water-out) configuration drastically reduces the void reactivity change compared to that case, when the same weighting spectrum (e.g. that of the water-in configuration) both the normal and the voided state of an APWR is used.

10995 (NUREG/CP—0091-Vol.4-Add.) Reflooding phenomena of German PWR estimated from CCTF [Cylindrical Core Test Facility], SCTF [Slab Core Test Facility] and UPTF [Upper Plenum Test Facility] results. Murao, Y.; Iguchi, T.; Sugimoto, J.; Akimoto, H.; Iwamura, T.; Okubo, T.; Ohnuki, A.; Sakaki, I.; Kikuta, M.; Adachi, H. (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Regulatory Research; Brookhaven National Lab., Upton, NY (USA)). Sep 1988. Contract AC02-76CH00016. 30p. (CONF-8710111—Vol.4-Add.). NTIS, PC A03/MF A01 - GPO - OSTI. Order Number TI89001586/JAW.

From 15. water reactor safety information meeting; Gaithersburg, MD, USA (26 Oct 1987).

The reflooding behavior in a PWR with a combined injection type ECCS was studied by comparing the test results from Cylindrical Core Test Facility (CCTF), Slab Core Test Facility (SCTF) and Upper Plenum Test Facility (UPTF). Core thermal-hydraulics is discussed mainly based on SCTF test data. In addition, the water accumulation behavior in hot legs and the break-through characteristics at tie plate are discussed.

10996 (ZJE—277) Service life of WWER-type reactor pressure vessels. Brumovsky, M. (Skoda, Plzen (Czechoslovakia). Zavod Vystavba Jadernych Elektraren). 1987. 13p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704165/JAW.

The analysis of the WWER-type reactor pressure vessels is dealt with. Presented are the basic dimensions of the vessels produced, the chemical composition of used steels, requirements imposed on short-time strength properties of steels, the calculation of pressure vessel strength, fracture toughness for various operating modes, the effect of size and shape of flaws, radiation, and of other factors involved. (author). 9 figs., 4 tabs.

2103 Power Reactors, Non-breeding, Graphite Moderated

REFER ALSO TO CITATION(S) 11084, 11085, 11120, 11125, 11787

10997 **(INIS-BR—1355) Environmental consequences of the Chernobyl nuclear reactor accident.** Smith, F.B. (Bahia Univ., Salvador (Brazil). Inst. de Quimica). 1987. 2p. (CONF-8709392—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88705153/JAW.

From 2. International Environmental Chemistry Congress; Salvador, Brazil (16 Sep 1987).

2104 Power Reactors, Non-breeding, Otherwise Moderated Or Unmoderated

REFER ALSO TO CITATION(S) 11024

10998 **(AECL—9179) Future trends in the design of CANDU reactors.** Dunn, J.T.; Lipsett, J.J.; Notley, M.J.F.; Spinks, N.J. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). Mar 1986. 33p. (CONF-8604411—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704987/JAW.

From 1990s water reactor design workshop; Seoul, Korea (19 Apr 1986).

The CANDU reactor system has proven itself to be a world leader in terms of station availability and low total unit energy cost. In 1985 four of the top ten reactor units in the world were CANDU reactors operating in South Korea and Canada. Engineering work is well underway to refine the design of the CANDU 600 and to incorporate state-of-the-art technology, reducing the capital cost and construction schedule for CANDUs of the 1990s. In addition, a smaller CANDU 300 plant has been designed using proven CANDU 600 technology and components, but with an innovative new plant layout that makes it cost competitive with coal-fired plants. For the long term, work on advanced fuel cycles and major system improvements are underway ensuring that CANDU plants will stay competitive well into the next century.

2105 Power Reactors, Breeding

REFER ALSO TO CITATION(S) 11031, 11073, 11138, 11571

10999 **(CEA-CONF—9439) Influence of swelling on tensile properties of 316 Ti cold-hammered hexagonal tubes.** Hugot, J.P. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Technologie). 1988. 11p. (In French). (CONF-8803168—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756217/JAW.

From GKAE-CEA seminar; Moscow, USSR (15 Mar 1988).

The main limitations of fast neutron reactor hexagonal tubes are generally deformation and irradiation embrittlement. If many data were published on deformations generated by swelling or irradiation creep, there are only few data on the mechanical behavior of the irradiated material. In this paper we give results of tensile testing on 316 Ti samples irradiated at high dose in Phenix reactor.

11000 **(CEA-CONF—9477) Influence of swelling on irradiated cw 316 Ti embrittlement.** Levy, V. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Technologie). 1988. 17p. (CONF-880613—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756218/JAW.

From 14. international symposium on effects of radiation on materials; Andover, MA, United States (27 Jun 1988).

For fast breeder reactors core materials, the main limitations are usually swelling and irradiation embrittlement. Tensile tests and Charpy tests performed on CW 316 Ti wrappers irradiated in PHENIX up to 100 dpa NRT have shown strong evidence of correlation between swelling and embrittlement. Tensile tests were performed at room temperature, at 200/sup 0/C and at irradiation temperature on tensile specimens machined from wrappers; the tests were done on different heats leading to different swelling values. Charpy tests were performed also at room temperature, 200/sup 0/C and irradiation temperature, on Charpy specimens machined from different wrappers. As swelling increases, first we observe a large decrease of the total energy absorbed by specimen rupture in Charpy tests and the absence of necking before failure in tensile tests; when swelling reaches about 6 %, the total energy in Charpy tests becomes very low and uniform elongation in tensile tests decreases; at higher swelling values failure in tensile tests may occur without any plastic deformation, the UTS itself decreasing sharply.

11001 **(CEA-CONF—9480) Mechanical behaviour of ferritic martensitic steels irradiated in Phenix. Introduction at the Icone irradiation.** Seran, J.L. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Technologie). 1988. 12p. (In French). (CONF-8803178—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756219/JAW.

From French-Soviet Seminar; Moscou, USSR (15 Mar 1988).

Ferritic-martensitic steels are actually possible candidates for material of fast neutron reactors hexagonal tubes. These steels possess a swelling and a creep resistance better than of classic 316 austenitic steels and present out of irradition, mechanical characteristics suitable for the proposed application and good manufacturing properties and sodium compatibility. In ferritic steels irradiation effects came forward at low temperature that for austenitic steels. In the precedent seminary we have shown that the maximum of swelling was unknown and takes probably place at a temperature below 400/sup 0/C. The same question sets up concerning the localization of temperature range in which the mechanical characteristics of ferritic steels are affected by irradiation. In this communication, we give the first results permitting to compare the mechanical properties in traction and in resilience observed after a 50 atom displacement irradiation on a F17 ferritic steel, a EM12 ferritic-martensitic steel and a EM 10 martensitic steel.

11002 **(CEA-CONF—9481) Irradiation effect on ferritic steels microstructure.** Gilbon, D. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Technologie). 1988. 19p. (In French). (CONF-8803178—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756220/JAW.

From French-Soviet Seminar; Moscou, USSR (15 Mar 1988).

The fast neutron reactor hexagonal tubes materials are submitted at more and more elevated doses. Austenitic steels present, after a long stay in reactor, strains principally by swelling which could penalizing for future. In this objective we develop new programs based on ferritic steels considered to be more resistant at swelling. Actually we dispose of many results on a F17 ferritic steel irradiated by neutrons in Phenix. Some observations on EM12 duplex steel irradiated by neutrons in Phenix are also realized. EM10 martensitic steel is irradiated only at low doses and it is difficult to compare its performance at the two first types.

11003 **(CONF-880911—24) Time constants and transfer functions for a homogeneous 900 MWt metallic fueled LMR.** Grimm, K.N.; Meneghetti, D. (Argonne National Lab., IL (USA)). 1988. Contract W-31109-ENG-38. 20p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004194/JAW.

From International reactor physics conference; Jackson Hole, WY, USA (18 Sep 1988).

Nodal transfer functions are calculated for a 900 MWt U10Zr-fueled sodium cooled reactor. From the transfer functions the time constants, feedback reactivity transfer function coefficients, and power coefficients can be determined. These quantities are calculated for core fuel, upper and lower axial reflector steel, radial blanket fuel, radial reflector steel, and B_4C rod shaft expansion effect. The quantities are compared to the analogous quantities of a 60 MWt metallic-fueled sodium cooled Experimental Breeder Reactor II configuration. 8 refs., 2 figs., 6 tabs.

11004 **(CONF-8809178—2) Uncertainty reduction requirements in cores designed for passive reactivity shutdown.** Wade, D.C. (Argonne National Lab., IL (USA)). 1988. Contract W-31109-ENG-38. 17p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004265/JAW.

From European Organization for Economic Cooperation and Development's Nuclear Energy Agency Committee on Reactor Physics (NAECRP) specialists meeting; Jackson Hole, WY, USA (23 Sep 1988).

The first purpose of this paper is to describe the changed focus of neutronics accuracy requirements existing in the current US advanced LMR development program where passive shutdown is a major design goal. The second purpose is to provide the background and rationale which supports the selection of a formal data fitting methodology as the means for the application of critical experiment measurements to meet these accuracy needs. 6 refs., 1 fig., 2 tabs.

11005 **(CONF-8809202—2) Experimental studies of U-Pu-Zr fast reactor fuel pins in EBR-II [Experimental Breeder Reactor].** Pahl, R.G.; Porter, D.L.; Lahm, C.E.; Hofman, G.L. (Argonne National Lab., Idaho Falls, ID (USA)). 1988. Contract W-31109-ENG-38. 34p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89003628/JAW.

From Symposium on irradiation-enhanced materials science; Chicago, IL, USA (25 Sep 1988).

The Integral Fast Reactor (IFR) is a generic reactor concept under development by Argonne National Laboratory. Much of the technology for the IFR is being demonstrated at the Experimental Breeder Reactor II (EBR-II) on the Department of Energy site near Idaho Falls, Idaho. The IFR concept relies on four technical features to achieve breakthroughs in nuclear power economics and safety: (1) a pool-type reactor configuration, (2) liquid sodium cooling, (3) metallic fuel, and (4) an integral fuel cycle with on-site reprocessing. The purpose of this paper will be to summarize our latest results of irradiation testing uranium-plutonium-zirconium (U-Pu-Zr) fuel in the EBR-II. 10 refs., 13 figs., 2 tabs.

11006 **(DOE/NE/37959—25) Signal validation in nuclear power plants: Progress report No. 7.** Upadhyaya, B.R. (Tennessee Univ., Knoxville (USA). Dept. of Nuclear Engineering). 19 Dec 1988. Contract AC02-86NE37959. 19p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004740/JAW.

This report summarizes the progress in the US Department of Energy sponsored project on Signal Validation for Nuclear Power Plants for the period September--December, 1988. The annual report for the period September 30, 1987--September 29, 1988, was submitted to the US Department of Energy. Several papers, related to the work performed under the project, have been presented at the ANS/ENS International Conference, Washington, DC and at the IEEE Conference on Decision and Control, Austin, Texas. Two sets of EBR-II data base have been acquired and are being used for testing the integrated signal validation system. A preliminary demonstration of the integrated signal validation system is operational in the Micro VAX-II workstation. 12 figs.

2106 Power Reactors, Auxiliary, Mobile, Package, And Transportable

11007 **(CONF-890103—3) A transient heat pipe model for a multimegawatt space power application.** Carlson, L.W. (Argonne National Lab., IL (USA)). 1989. Contract W-31109-ENG-38. 5p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89003969/JAW.

From 6. symposium on space nuclear power systems; Albuquerque, NM, USA (9 Jan 1989).

The Argonne "Monolithic Solid Oxide Fuel Cell" power generation system has been described previously. In a "burst power" generation mode, hundreds of megawatts of DC power would be generated for a finite time interval. An accompanying nuclear power generation system would be used to regenerate the spent reactants (hydrogen and oxygen) in this closed system for subsequent re-use. Although the Argonne space power supply was designed to be a closed system in terms of material effluents, it had to reject the waste heat from the fuel cells (which operate with approximately 70% conversion efficiency). The heat rejection method included multiple heat pipes operated in parallel to convey thermal energy from the fuel cell coolant for ultimate radiation-rejection to space. These individual heat pipes featured a convectively heated evaporator section, an adiabatic section leading out from the fuel cell chamber to space, and the condenser section radiating to space. The transient behavior of these heat rejection heat pipes was not considered previously. This paper addresses the problem, showing that the heat pipes as conceptually designed also satisfy the stringent transient power generation---heat rejection requirements of the multimegawatt power generation system. 4 refs., 4 figs.

2107 Regulation And Licensing

REFER ALSO TO CITATION(S) 11053, 11054, 11080, 11098, 11104

11008 **(EPRI-NP—6200) A performance-based selective inspection process (NCIG-09): Final report.** McKenna, T.A.; Amin, M. (Electric Power Research Inst., Palo Alto, CA (USA); Sargent and Lundy, Chicago, IL (USA)). Dec 1988. 67p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI89004723/JAW.

This document provides an approach for planning and performing selective inspections of fabrication, construction, modification, repair, and testing activities that affect the quality of the structures, systems, and components of nuclear power plants. Implementing a selective inspection process will verify the quality of the installation, ensure the accuracy of the inspection personnel, and provide for prompt identification of conditions adverse to quality. Guidance is provided for establishing assurance of quality and for adjusting inspection practices as required by the performance and assessment of results. This document is not applicable when 100% inspection is required by code or other authority. 4 figs., 2 tabs.

11009 **(NUREG—0040-Vol.12-No.3) Licensee contractor and vendor inspection status report: Quarterly report, July 1988--September 1988.** (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Reactor Inspection and Safeguards). Dec 1988. 119p. NTIS, PC A06/MF A01 - GPO - OSTI. Order Number TI89004842/JAW.

This periodical covers the results of inspections performed by the NRC's Vendor Inspection Branch that have been distributed to the inspected organization during the period from July 1988 through September 1988. Also included in this issue are the results of certain inspections performed prior to April 1988, May 1988 and June 1988 that were not included in previous issues of NUREG-0040.

11010 **(NUREG—0386-Digest.4-Rev.10) United States Nuclear Regulatory Commission staff practice and procedure digest: Commission, Appeal Board and Licensing Board decisions, July 1972--December 1987.** (Nuclear Regulatory Commission, Washington, DC (USA). Office of the General Counsel). Nov 1988. 498p. NTIS, PC A21/MF A01 - GPO - OSTI. Order Number TI89004340/JAW.

This Revision 10 of the fourth edition of the NRC Staff Practice and Procedure Digest contains a digest of a number of Commission, Atomic Safety and Licensing Appeal Board, and Atomic Safety and licensing Board decisions issued during the period from July 1, 1972 to December 31, 1987 interpreting the NRC's Rules of Practice in 10 CFR Part 2. This Revision 10 replaces in part earlier editions and supplements and includes appropriate changes reflecting the amendments to the Rules of Practice effective through December 31, 1987. The Digest is roughly structured in accordance with the chronological sequence of the nuclear facility licensing process as set forth in Appendix A to 10 CFR Part 2. Those decisions which did not fit into that structure are dealt with in a section on "general matters." Where appropriate, particular decisions are indexed under more than one heading. Some topical headings contain no decision citations or discussion.

11011 **(NUREG—0750-Vol.28-No.4) Nuclear Regulatory Commission Issuances.** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Administration and Resources Management). Oct 1988. 89p. NTIS, PC A05/MF A01 - GPO - OSTI. Order Number TI89004074/JAW.

This report includes the issuances received during the specified period from the Commission (CLI), the Atomic Safety and Licensing Appeal Boards (ALAB), the Atomic Safety and Licensing Boards (LBP), the Administrative Law Judge (ALJ), the Directors' Decisions (DD), and the Denials of Petitions for Rulemaking (DPRM).

11012 **(NUREG/CP—0099) Proceedings of the Public Workshop for NRC rulemaking on maintenance of nuclear power plants.** Dey, Moni; Tabatabai, A.; Scott, W. (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Regulatory Research; Pacific Northwest Lab., Richland, WA (USA)). Nov 1988. Contract AC06-76RL01830. 370p. (PNL-SA—16308; CONF-8807138—). NTIS, PC A16/MF A01 - GPO - OSTI. Order Number TI89003451/JAW.

From NRC rulemaking on maintenance of nuclear power plants; Washington, DC, United States (11 Jul 1988).

This report presents the proceedings of the Public Workshop for NRC Rulemaking on the Maintenance of Nuclear Power Plants. The workshop was held on July 11--13, 1988, in Washington, DC. Its purpose was to solicit early public and industry participation in and comments on a rulemaking process recently initiated by the United States Nuclear Regulatory Commission (NRC) to improve the conduct and effectiveness of maintenance practices in US commercial nuclear power plants.

11013 **(NUREG/CR—2000-Vol.7-No.10) Licensee Event Report (LER) compilation for month of October 1988.** (Nuclear Regulatory Commission, Washington, DC (USA). Office for Analysis and Evaluation of Operational Data; Oak Ridge National Lab., TN (USA)). Nov 1988. Contract AC05-84OR21400. 89p. (ORNL/NSIC—200-Vol.7-No.10). NTIS, PC A05/MF A01 - GPO - OSTI. Order Number TI89004388/JAW.

This monthly report contains Licensee Event Report (LER) operational information that was processed into the LER data file of the Nuclear Safety Information Center (NSIC) during the one month period identified on the cover of the document. The LERs, from which this information is derived, are submitted to the Nuclear Regulatory Commission (NRC) by nuclear power plant licensees in accordance with federal regulations. Procedures for LER reporting for revisions to those events occurring prior to 1984 are described in NRC Regulatory Guide 1.16 and NUREG-1061, Instructions for Preparation of Data Entry Sheets for Licensee Event Reports. For those events occurring on and after January 1, 1984, LERs are being submitted in accordance with the revised rule contained in Title 10 Part 50.73 of the Code of Federal Regulations (10 CFR 50.73--Licensee Event Report System) which was published in the Federal Register (Vol. 48, No. 144) on July 26, 1983. NUREG-1022, Licensee Event Report System--Description of Systems and Guidelines for Reporting, provides supporting guidance and information on the revised LER rule.

22 NUCLEAR REACTOR TECHNOLOGY

REFER ALSO TO CITATION(S) 10981, 10982, 11614

2201 Theory And Calculation

REFER ALSO TO CITATION(S) 10994, 11067, 11068, 11076, 11125

11014 **(CONF-880911—26) Integral transport treatment of transitional resonance spectra.** Hill, R.N.; Ott, K.O.; Rhodes, J.D. (Argonne National Lab., IL (USA)). 1988. Contract W-31109-ENG-38. 15p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89003886/JAW.

From International reactor physics conference; Jackson Hole, WY, USA (18 Sep 1988).

Analytical exploratory investigations indicated that transition effects such as streaming will cause a considerable spatial variation in the neutron spectra across resonances; streaming leads to opposite effects in the forward and backward directions. The neglect of this spatial and angular variation of the transitory resonance spectra is an approximation that is common to all current methodologies. An integral transport theory formalism was developed for the description of spatially dependent spectra in isolated resonances. This treatment differentiates between forward and backward directed components of the neutron flux in slab geometry. This theory was applied to an isolated actinide resonance in a simplified fast reactor blanket problem. The resonance spectra of the directional flux components, {phi}$^{+}$ and {phi}$^{-}$, and even more so the 90{degree} cone components, were shown to deviate significantly from the infinite medium approximation with the differences increasing with penetration. The changes in {phi}$^{+}$ lead to a decreasing scattering group constant which enhances neutron transmission; the changes in {phi}$^{-}$ lead to an increasing group constant inhibiting backward scattering. Therefore, the changes in the forward and backward directed spectra both lead to increased neutron transmission. Conversely, the flux ({phi}={phi}$^{+}$+{phi}$^{-}$) was shown both in the analytical formulas and in the numerical solution to agree closely with the infinite medium approximation; the directional effects cancel in the summation. Therefore, flux-weighted ("diffusion theory") group constants cannot yield the required increase in transmission even using transport theory. 8 refs., 2 figs.

2202 Components And Accessories

REFER ALSO TO CITATION(S) 11008, 11009, 11030, 11134, 11136, 11338, 11339, 11524

11015 **(CONF-8810155—24) Results of irradiated cladding tests and clad plate experiments.** Haggag, F.M.; Iskander, S.K. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 22p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004187/JAW.

From 16. water reactor safety information meeting; Gaithersburg, MD, USA (24 Oct 1988).

Two aspects critical to the fracture behavior of three-wire stainless steel cladding were investigated by the Heavy-Section Steel Technology (HSST) Program: (1) radiation effects on cladding strength and toughness, and (2) the response of mechanically loaded, flawed structures in the presence of cladding (clad plate experiments). Postirradiation testing results show that, in the test temperature range from {minus}125 to 288{degree}C, the yield strength increased, and ductility insignificantly increased, while there was almost no change in ultimate tensile strength. All cladding exhibited ductile-to-brittle transition behavior during Charpy impact testing. Radiation damage decreased the Charpy upper-shelf energy by 15 to 20% and resulted in up to 28{degree}C shifts of the Charpy impact transition temperature. Results of irradiated 12.5-mm-thick compact specimens (0.5TCS) show consistent decreases in the ductile fracture toughness, J/sub Ic/, and the tearing modulus. Results from clad plate tests have shown that (1) a tough surface layer composed of cladding and/or heat-affected zone has arrested running flaws under conditions where unclad plates have ruptured, and (2) the residual load-bearing capacity of clad plates with large subclad flaws significantly exceeded that of an unclad plate. 13 figs., 1 tab.

11016 **(DPST—88-781) Gamma ray irradiation damage to SRP reactor tank walls.** Baumann, N.P. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). Oct 1988. Contract AC09-76SR00001. 38p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004601/JAW.

A displacement cross section for gamma ray energies up to 10 MeV has been developed. It was obtained by taking known displacement computations for beta particles and integrating them over cross sections and beta spectra for Compton and pair-formation gamma events. The displacement cross section was computed for iron, but is applicable to 304 or 316 stainless steel with little error since the average atomic number for stainless steel differs little from that of iron alone. This small difference is further re-

duced by expressing the cross section as a per electron value rather than the conventional per atom value. Transport computations for SRP rector tank walls indicate that damage from gamma rays is small compared to fast and slow neutron damage, but that it is not negligible. Most of this damage comes from gamma rays created in the tank wall and nearby shield wall by thermal neutron capture. As a result, in most cases the gamma damage may be included as an augmentation of the (n,gamma) displacement cross section. 9 refs., 5 figs., 8 tabs.

11017 **(EPRI-NP—5613-Vol.2) Procedures for treating common cause failures in safety and reliability studies: Volume 2, Analytic background and techniques: Final report.** Mosleh, A.; Fleming, K.N.; Parry, G.W.; Paula, H.M.; Worledge, D.H.; Rasmuson, D.M. (Electric Power Research Inst., Palo Alto, CA (USA); Pickard, Lowe and Garrick, Inc., Newport Beach, CA (USA)). Dec 1988. 131p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI89004725/JAW.

This report presents a framework for the inclusion of the impact of common cause failures in risk and reliability evaluations. Common cause failures are defined as that subset of dependent failures for which causes are not explicitly included in the logic model as basic events. The emphasis here is on providing procedures for a practical, systematic approach that can be used to perform and clearly document the analysis. The framework and the methods discussed for performing the different stages of the analysis integrate insights obtained from engineering assessments of the system and the historical evidence from multiple failure events into a systematic, reproducible, and defensible analysis. This document, Volume 2, contains a series of appendices that provide additional background and methodological detail on several important topics discussed in Volume 1.

11018 **(INFO—0243) Detection and mitigation of aging and service wear effects of nuclear power plant components in Canada.** Pachner, J. (Atomic Energy Control Board, Ottawa, Ontario (Canada)). Jul 1987. 15p. (CONF-870604—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705141/JAW.

From International symposium on safety aspects of the aging and maintenance of nuclear power plants; Vienna, Austria (29 Jun 1987).

In Canada, the operational safety management of nuclear power plants employs methods which are intended to prevent, detect, correct and mitigate system and component failures from any cause, including the effects of aging and service wear degradation. The paper gives an overview of the application of these methods in the detection and mitigation of aging effects before they impact on plant safety and production reliability. Regulatory audits of these methods, to ensure that an acceptable level of plant safety is maintained by the nuclear power plant licensees, are also described. The methods are: a preventive maintenance program, Significant Event Reporting system, and a reliability based assessment of performance of safety related systems. The above methods are discussed and illustrated by examples. The soundness of the approach has been proven by the results achieved in 163 reactor-years of operation. Present and future developments include reviews of current monitoring, testing and inspection methods to ensure that appropriate time variant parameters (capable of revealing aging degradation before loss of functional capability) are monitored, and reviews of the effectiveness of existing maintenance programs and methods in mitigating aging and service wear effects.

2203 Fuel Elements

REFER ALSO TO CITATION(S) 11015, 11665

11019 **(CNIC—00001) Measuring equivalent thermal conductivity of UO/sub 2/ fuel element under irradiation.** Yu Jinnan; Chen Huizhong; Deng Fengxiang; Guo Xingqu; Xi Daoquan. (Academia Sinica, Beijing (China). Inst. of Atomic Energy). (China Nuclear Information Centre, Beijing, BJ). 1986. 14p. (In Chinese). (IAE—0001). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704087/JAW.

The equivalent thermal conductivity (ETC) is a comprehensive description of both fuel pellet and gas gap conductivity. The equation of ETC has been derived in this paper. Values of ETC have been measured at different levels of reactor power while the centre temperature of fuel pellet between 632-1988 centigrade degree. Results obtained shown that ETC increase firstly with the centre temperature and then decrease. After the centre temperature of fuel pellet is higher than about 1800 centigrade degree, ETC increase with the centre temperature again. The effects of fuel pellet shape factor, cladding materials and the inside temperature of clad wall on ETC were also discussed.

11020 **(CNIC—00108) Development of precipitator of fluid film type.** Liu Yupu. (Academia Sinica, Beijing (China). Inst. of Atomic Energy). (China Nuclear Information Centre, Beijing, BJ). 1987. 17p. (In Chinese). (IAE—0033). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704101/JAW.

The precipitator of fluid film type is developed for the determination of fuel element cladding failure of water-cooled reactor. It integrates the scrubber, precipitator and detector. The jet of element cooling water automatically circulates carrier gas and the flow water film transfers precipitates onto the surface of centre electrode. Three different types are designed. On the special test loop, the uranium sample pellets of simulating cladding failure is measured. The sensitivity of precipitators, saturated precipitation voltage, incremental speed of signal, speed of driving out precipitates and the contents of the precipitates are determined. The test shows that the precipitators are highly sensitive, reliable, cheap and easy to operate.

11021 **(CNIC—00122) HFETR spent fuel elements as radiation source and its uses.** Li Keming; Li Zhiqing; Zhang Zicai; Tong Zhipei; Lin Jisen. (Southwest Inst. of Nuclear Reactor Engineering, SC (China)). (China Nuclear Information Centre, Beijing, BJ). 1987. 9p. (In Chinese). (SINRE—0007). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704102/JAW.

This article presents the main results of the radiation research on the spent fuel elements in HFETR. The spent fuel element irradiation facilities and its measurement results are described. It also gives the experimental results on the radiation crosslinking of polyethylene and radiation degradation of polytetrafluoroethylene by the spent fuel element irradiation. The value of the spent fuel elements as γ radiation source for radiation processing is well demonstrated.

2204 Control Systems

REFER ALSO TO CITATION(S) 11134

11022 **(CONF-8805230—1) A generic task approach to a real time nuclear power plant fault diagnosis and advisory system.** Hajek, B.K.; Miller, D.W.; Bhatnagar, R.; Stasenko, J.E.; Punch, W.F. III; Yamada, N. (Ohio State Univ., Columbus (USA). Nuclear Engineering Program). 1988. Contract AC02-86NE37965. 10p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89003405/JAW.

From International workshop on artificial intelligence for industrial applications; Hitachi City, Japan (25 May 1988).

A generic task toolkit developed at The Ohio State University Laboratory for Artificial Intelligence Research (LAIR) has been used in the development of an aid for operators of nuclear power plants. The toolkit consists of high level programming tools that enable knowledge to be used in accordance with its need. That is, if diagnosis is the need, a framework for performing diagnosis is provided. The operator aid provides for monitoring the conditions in the plant, detecting abnormal events, and providing the operator with guidance and advice through procedures on what path should be followed to mitigate the consequences. 8 refs., 5 figs.

11023 **(EPRI-NP—6143) Implementation of a digital feedwater control system at Dresden Nuclear Power Plant, Units 2 and 3: Final report.** Zapotocky, A.; Popovic, J.R.; Fournier, R.D. (Electric Power Research Inst., Palo Alto, CA (USA); Commonwealth Edison Co., Morris, IL (USA); Atomic Energy of Canada Ltd., Mississauga, Ontario). Dec 1988. 227p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI89004484/JAW.

This report describes the Digital Feedwater Control System Implementation at the Dresden 2 or 3 Units of the BWR Nuclear Power Plant owned by the Commonwealth Edison Company. The digital system has been operational in Unit 3 since August 1986, and in Unit 2 since April 1987. The Bailey Control's Network 90 based digital control system replaced the obsolete GE/MAC 5000 analog control system in the reactor feedwater control loop as a "like-for-like" replacement. Operational experience from the Digital Feedwater Control installations has been good and the system demonstrated better performance than the old analog systems. 14 refs., 15 figs., 17 tabs.

11024 **(INFO—0228) Simulation of Darlington shutdown and regulation systems.** (Atomic Energy Control Board, Ottawa, Ontario (Canada); Serdula Systems Ltd., Deep River, Ontario (Canada)). Oct 1986. 14p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705265/JAW.

In Microsoft Fortran Version 3.2 for IBM personal computer.

This report describes the development of a simulation of the Darlington Nuclear Generating Station shutdown and regulating systems, DARSIM. The DARSIM program simulates the spatial neutron dynamics, the regulation of the reactor power, and Shutdown System 1, SDS1, and Shutdown System 2, SDS2, software. The DARSIM program operates in the interactive simulation (INSIM) program environment.

11025 (INIS-mf—11332, pp 10) **Use of a digital reactivity meter on Triga reactor for instrumentation and training purposes.** Glumac, B. 1988. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705189/JAW. (CONF-8809213—).

From IAEA Meeting: 10th European TRIGA users' conference; Vienna, Austria (14 Sep 1988).

11026 (INIS-mf—11332, pp 12) **Concepts for the renewal of the instrumentation of the Triga reactor Vienna.** Boeck, H.; Hammer, J.; Zugarek, G. (Atominstitut der Oesterreichischen Universitaeten, Vienna). 1988. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705189/JAW. (CONF-8809213—).

From IAEA Meeting: 10th European TRIGA users' conference; Vienna, Austria (14 Sep 1988).

11027 (INIS-mf—11332, pp 13) **Operating data documentation system for a research reactor.** Hammer, J.; Kasparec, F. (Atominstitut der Oesterreichischen Universitaeten, Vienna). 1988. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705189/JAW. (CONF-8809213—).

From IAEA Meeting: 10th European TRIGA users' conference; Vienna, Austria (14 Sep 1988).

11028 (INIS-mf—11332, pp 9) **Microprocessor based energy-meter concept for Triga Mark-2 reactor.** Bayuelken, A.R.; Seker, S. (Istanbul Technical Univ. (Turkey). Inst. for Nuclear Energy; Istanbul Technical Univ., Faculty of Electrical Engineering, Istanbul (Turkey)). 1988. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705189/JAW. (CONF-8809213—).

From IAEA Meeting: 10th European TRIGA users' conference; Vienna, Austria (14 Sep 1988).

11029 (INIS-mf—11332, pp 43) **Reactor surveillance by noise analysis.** Ciftcioglu, O. (Istanbul Technical Univ., Division of Nuclear Power, Faculty of Electrical and Electronics Engineering,Istanbul (Turkey)). 1988. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705189/JAW. (CONF-8809213—).

From IAEA Meeting: 10th European TRIGA users' conference; Vienna, Austria (14 Sep 1988).

11030 **(SAND—88-2151C) Condition monitoring and aging assessment of Class 1E cables.** Jacobus, M.J. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 20p. (CONF-8810244—2). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89002360/JAW.

From 16. light water reactor safety conference; Washington, DC, USA (24 Oct 1988).

Sandia National Laboratories is currently conducting long-term aging research on representative samples of nuclear power plant Class 1E cables. The objectives of this program are to determine the suitability of these cables for extended life (beyond 40 year design basis) and to assess various cable condition monitoring (CM) techniques for predicting remaining cable life. The cables are being aged for long times at relatively mild exposure conditions with various CM techniques being employed during the aging process. Following the aging process, the cables will be exposed to a sequential accident profile consisting of high dose rate irradiation followed by a simulated design basis loss-of-coolant accident (LOCA) steam exposure. This paper covers two aspects of the research program: the electrical measurement techniques that have been developed and are being performed and some initial data that has been generated from these measurement techniques. The electrical measurements include insulation resistance, polarization index, capacitance, and dissipation factor.

2205 Environmental Aspects

REFER ALSO TO CITATION(S) 10988, 11071, 11072, 11119, 11124, 11138, 11773

11031 **(CONF-880903—45) Immobilization of IFR salt wastes in mortar.** Fischer, D.F.; Johnson, T.R. (Argonne National Lab., IL (USA)). 1988. Contract W-31109-ENG-38. 9p. NTIS, PC A02/MF A01 - OSTI. Order Number DE89003950/JAW.

From Spectrum '88: international topical meeting on nuclear and hazardous waste management; Pasco, WA, United States (11 Sep 1988).

Portland cement-base mortars are being considered for immobilizing chloride salt wastes produced by the fuel cycles of Integral Fast Reactors (IFR). The IFR is a sodium-cooled fast reactor with metal alloy fuels. It has a close-coupled fuel cycle in which fission products are separated from the actinides in an electrochemical cell operating at 500{degree}C. This cell has a liquid cadmium anode in which the fuels are dissolved and a liquid salt electrolyte. The salt will be a mixture of either lithium, potassium, and sodium chlorides or lithium, calcium, barium, and sodium chlorides. One method being considered for immobilizing the treated nontransuranic salt waste is to disperse the salt in a portland cement-base mortar that will be sealed in corrosion-resistant containers. For this application, the grout must be sufficiently fluid that it can be pumped into canister-molds where it will solidify into a strong, leach-resistant material. The set times must be longer than a few hours to allow sufficient time for processing, and the mortar must reach a reasonable compressive strength ({approximately}7 MPa) within three days to permit handling. Because fission product heating will be high, about 0.6 W/kg for a mortar containing 10% waste salt, the effects of elevated temperatures during curing and storage on mortar properties must be considered.

11032 **(DP-MS—88-153) The derivation and verification of surface reflectances using airborne MSS data and a radiative transfer model.** Ramsey, E.W. III; Jensen, J.R. (South Carolina Univ., Columbia (USA). Dept. of Geography). 1988. Contract AC09-76SR00001. 17p. (CONF-8809220—2). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004881/JAW.

From Fall technical meeting of the American Society of Photogrammetry and Remote Sensing; Virginia Beach, VA, USA (11 Sep 1988).

Surface reflectance images were derived from airborne MSS data using a radiative transfer model to eliminate atmospheric effects and to derive downwelling irradiances. Input radiative transfer model parameters and Brightness Value (BV) to radiance conversion gain and bias factors were generated for each band using an optimization procedure to minimize the difference between modelled and image BV. Subsequently, reflectance images were derived at five wavelengths from the blue to red bands using the optimized parameters as inputs into the radiative transfer model. Modelled surface reflectance images were evaluated for accuracy by statistical comparison to measured reflectances, and for improved contrast by subjective comparison to the original images. Daedalus DS-1260 MSS bands 3, 4 and 5 modelled reflectances explained 25%, 75% and 72% of the measured reflectance variances, respectively; while bands 2 and 7 correlation were not significant ($p < .05$). Finally, the generated reflectance images showed dramatic improvement in contrast, revealing textures that were not apparent in the original images. 20 refs., 4 figs., 3 tabs.

11033 **(INIS-BR—1356) Chernobyl accident and hot particles in the fallout.** Raunemaa, T.; Lehtinen, S.; Saari, H.; Kulmala, M. (Kuopio Univ. (Finland). Dept. of Environmental Health; Helsinki Univ. (Finland). Inst. of Electron Microscopy; Helsinki Univ. (Finland). Dept. of Physics). (Bahia Univ., Salvador (Brazil). Inst. de Quimica). 1987. 2p. (CONF-8709392—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88705154/JAW.

From 2. International Environmental Chemistry Congress; Salvador, Brazil (16 Sep 1987).

2206 Research, Test, And Experimental Reactors

REFER ALSO TO CITATION(S) 10837, 11005, 11025, 11026, 11027, 11028, 11029, 11031, 11121, 11122, 11123, 11124, 11655, 11889, 12310

11034 **(AECL—9061) Assessment of beam tube performance for the maple research reactor.** Lee, A.G. (Atomic Energy of Canada Ltd., Pinawa, Manitoba. Whiteshell Nuclear Research Establishment). Jun 1986. 21p. (CONF-860613—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704982/JAW.

From 26. annual international conference of the Canadian Nuclear Association and the 7. annual conference of the Canadian Nuclear Society; Toronto, Ontario, Canada (8 Jun 1986).

The MAPLE research reactor is a versatile new research facility that can be adapted to meet the requirements of a variety of reactor applications. A particular group of reactor applications involves the use of beams of radiation extracted from the reactor core via tubes that penetrate through the biological shield and terminate in the reflector surrounding the fuelled core. An assessment is given of the neutron and gamma radiation fields entering beam tubes that are located radially or tangentially with respect to the core.

11035 **(ANL/RERTR/TM—12) A computer code, NATCON, for the analyses of steady-state thermal-hydraulics and safety margins in plate-type research reactors cooled by natural convection.** Smith, R.S.; Woodruff, W.L. (Argonne National Lab., IL (USA)). Dec 1988. Contract W-31109-ENG-38. 37p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004509/JAW.

The NATCON code provides a capability for the analysis of the thermal-hydraulics of plate-type research reactors cooled by natural convection. The code includes steady-state estimates of what are often considered safety margins. These estimates may include power peaking factors, hot channel factor components, and laminar flow entrance effects. A listing of the code and a description of the input are included, along with some sample results. The current version of the code has only properties data for light water. 4 refs., 3 figs., 11 tabs.

11036 **(EGG-NERD—8131) Comparison of single and split core concepts for the Advanced Neutron Source.** Ryskamp, J.M.; Oh, C.H.; Lake, J.A.; Lussie, W.G.; Wadkins, R.P. (EG and G Idaho, Inc., Idaho Falls (USA)). Sep 1988. Contract AC07-76ID01570. 82p. NTIS, PC A05/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004870/JAW.

An Advanced Neutron Source, producing ultrahigh neutron flux intensities is being designed for materials sciences, isotope production, and fundamental physics research. Two reactor concepts have been proposed for the Advanced Neutron Source (ANS). The Idaho National Engineering Laboratory (INEL) is examining a split core reactor, and Oak Ridge National Laboratory (ORNL) is examining a single core reactor. The purpose of this report is to consistently compare the performance, as calculated by INEL, for these two reactor designs. This information can be used to help select the features of the concept that best meets the design requirements. 26 refs., 29 figs., 10 tabs.

11037 **(HMI-B—452) Planned instrumentation of the research reactor BER II.** Steiner, M. (comp.). (Hahn-Meitner-Institut Berlin G.m.b.H. (Germany, F.R.). Bereich Kernchemie und Reaktor). Aug 1988. 83p. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88756358/JAW.

Description of neutron spectrometers and diffractometers including data sheets and of irradiation rigs.

11038 (INIS-mf—11332, pp 38) **New handling tool for irradiation samples at the LENA plant.** Alloni, L.; Venturelli, A. (Pavia Univ. (Italy)). 1988. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705189/JAW. (CONF-8809213—).

From IAEA Meeting: 10th European TRIGA users' conference; Vienna, Austria (14 Sep 1988).

11039 **(INIS-mf—11332) 10th European TRIGA users conference.** Anon. (Atominstitut der Oesterreichischen Universitaeten, Vienna). 1988. 47p. (CONF-8809213—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705189/JAW.

From IAEA Meeting: 10th European TRIGA users' conference; Vienna, Austria (14 Sep 1988).

Abstracts of 46 papers on various aspects of Triga reactors (mainly Triga Mark 2 reactors) are given, according to the main headings: reactor operation and maintenance experience; new developments and improvements of Triga components and systems, including instrumentation; fuel and fuel management; safety aspects, licensing and radiation protection; experiments with Triga reactors; radiochemistry, radioisotope production and NAA; reactor physics. (qui).

11040 (INIS-mf—11332, pp 1) **Worldwide utilization of Triga reactors.** Muranaka, R. (International Atomic Energy Agency, Vienna (Austria)). 1988. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705189/JAW. (CONF-8809213—).

From IAEA Meeting: 10th European TRIGA users' conference; Vienna, Austria (14 Sep 1988).

11041 (INIS-mf—11332, pp 2) **Operating experience and maintenance of the Triga Mark 2 reactor in Ljubljana.** Dimic, V.; Pregl, G. (Institut Jozef Stefan, Ljubljana (Yugoslavia)). 1988. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705189/JAW. (CONF-8809213—).

From IAEA Meeting: 10th European TRIGA users' conference; Vienna, Austria (14 Sep 1988).

11042 (INIS-mf—11332, pp 3) **9 years of operation of ITU-NEE Triga Mark-2 reactor.** Yavuz, H.; Bayuelken, A.R.; Yavuz, M.A. 1988. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705189/JAW. (CONF-8809213—).

From IAEA Meeting: 10th European TRIGA users' conference; Vienna, Austria (14 Sep 1988).

11043 (INIS-mf—11332, pp 4) **Initial operation and utilization of a 3MW Triga research reactor.** Mannan, M.A.; Hossain, M. (Atomic Energy Centre, Dacca (Bangladesh)). 1988. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705189/JAW. (CONF-8809213—).

From IAEA Meeting: 10th European TRIGA users' conference; Vienna, Austria (14 Sep 1988).

11044 (INIS-mf—11332, pp 5) **Operating experiences at the Finnish Triga reactor.** Salmenhaara, S. (Valtion Teknillinen Tutkimuskeskus, Espoo (Finland)). 1988. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705189/JAW. (CONF-8809213—).

From IAEA Meeting: 10th European TRIGA users' conference; Vienna, Austria (14 Sep 1988).

11045 (INIS-mf—11332, pp 6) **Accumulated experience with the Brazilian IPR-R1 research reactor.** Carvalho, P.M. de; Carvalho, T.P. de. 1988. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705189/JAW. (CONF-8809213—).

From IAEA Meeting: 10th European TRIGA users' conference; Vienna, Austria (14 Sep 1988).

11046 (INIS-mf—11332, pp 7) **Operating experience and maintenance at the Triga Mark 2 Lena reactor.** Cingoli, F.; Altieri, S.; Lana, F.; Rosti, G.; Alloni, L.; Meloni, S. (Pavia Univ. (Italy)). 1988. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705189/JAW. (CONF-8809213—).

From IAEA Meeting: 10th European TRIGA users' conference; Vienna, Austria (14 Sep 1988).

11047 (INIS-mf—11332, pp 8) **Operation experience with the Triga reactor Vienna.** Boeck, H.; Hammer, J.; Zugarek, G. (Atominstitut der Oesterreichischen Universitaeten, Vienna). 1988. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705189/JAW. (CONF-8809213—).

From IAEA Meeting: 10th European TRIGA users' conference; Vienna, Austria (14 Sep 1988).

11048 (INIS-mf—11332, pp 11) **Replacement of the cooling system at the Triga Mainz reactor.** Menke, H. (Mainz Univ. (Germany, F.R.). Inst. fuer Kernchemie). 1988. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705189/JAW. (CONF-8809213—).

From IAEA Meeting: 10th European TRIGA users' conference; Vienna, Austria (14 Sep 1988).

11049 (INIS-mf—11332, pp 14) **Reactivity effects in mixed Triga cores.** Ravnik, M.; Mele, I.; Kodeli, I. (Institut Jozef Stefan, Ljubljana (Yugoslavia)). 1988. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705189/JAW. (CONF-8809213—).

From IAEA Meeting: 10th European TRIGA users' conference; Vienna, Austria (14 Sep 1988).

11050 (INIS-mf—11332, pp 15) **Effects of SS-304 cladding on core calculations Istanbul Triga Mark-2 reactor.** Guengoer, S. (Cukurova Univ., Fizik Boeluemue, Balcali-Adana (Turkey)). 1988. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705189/JAW. (CONF-8809213—).

From IAEA Meeting: 10th European TRIGA users' conference; Vienna, Austria (14 Sep 1988).

11051 (INIS-mf—11332, pp 17) **Fuel element replacement and cooling water radioactivity at the Musashi reactor.** Nozaki, T.; Honda, T.; Horiuchi, N.; Aizawa, O.; Sato, T. (Musashi Inst. of Tech., Kawasaki, Kanagawa (Japan). Atomic Energy Research Lab.). 1988. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705189/JAW. (CONF-8809213—).

From IAEA Meeting: 10th European TRIGA users' conference; Vienna, Austria (14 Sep 1988).

11052 (INIS-mf—11332, pp 18) **Identification of corrosion products from Triga fuels cladding and reactor component.** Sardjono, Y.; Syarip; Salman, S. (Yogyakarta Nuclear Research Centre, Batan (Indonesia)). 1988. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705189/JAW. (CONF-8809213—).

From IAEA Meeting: 10th European TRIGA users' conference; Vienna, Austria (14 Sep 1988).

11053 (INIS-mf—11332, pp 19) **Some aspects of licensing, periodic inspections and backfitting of Triga reactors.** Weiss, H. (Technische Univ., Graz (Austria)). 1988. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705189/JAW. (CONF-8809213—).

From IAEA Meeting: 10th European TRIGA users' conference; Vienna, Austria (14 Sep 1988).

11054 (INIS-mf—11332, pp 20) **Reactor physics analysis of the Musashi reactor for licensing purposes.** Kadotani, H.; Takami, M.; Aizawa, O.; Sato, T. (Century Research Center Corp., Tokyo (Japan); Musashi Inst. of Tech., Kawasaki, Kanagawa (Japan). Atomic Energy Research Lab.). 1988. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705189/JAW. (CONF-8809213—).

From IAEA Meeting: 10th European TRIGA users' conference; Vienna, Austria (14 Sep 1988).

11055 (INIS-mf—11332, pp 34) **Analysis of Triga application for irradiation of power reactor pressure vessel specimens.** Ravnik, M.; Mele, I. (Institut Jozef Stefan, Ljubljana (Yugoslavia)). 1988. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705189/JAW. (CONF-8809213—).

From IAEA Meeting: 10th European TRIGA users' conference; Vienna, Austria (14 Sep 1988).

11056 (INIS-mf—11332, pp 35) **Performance of the subcritical assembly using the radial beamport of Triga reactor as a neutron source.** Syarip; Sardjono, J.; Salman, M.S.; Tjiptono, T.W. (Yogyakarta Nuclear Research Centre, Yogyakarta (Indonesia)). 1988. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705189/JAW. (CONF-8809213—).

From IAEA Meeting: 10th European TRIGA users' conference; Vienna, Austria (14 Sep 1988).

11057 (INIS-mf—11332, pp 41) **Epithermal neutron flux characterisation of the Triga Mark 2 reactor, Ljubljana, Yugoslavia for use in NAA.** Smodis, B.; Jacimovic, R.; Stegnar, P.; Jovanovic, S.; Vukotic, P.; Mihaljevic, N. (Institut Jozef Stefan, Ljubljana (Yugoslavia); Univ. 'V. Vlahovic', Titograd (Yugoslavia)). 1988. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705189/JAW. (CONF-8809213—).

From IAEA Meeting: 10th European TRIGA users' conference; Vienna, Austria (14 Sep 1988).

11058 (INIS-mf—11332, pp 42) **Nonlinear dynamics of ITU Triga reactor.** Hizal, A.; Gencay, S.; Geckinli, M.; Ciftcioglu, O.; Can, B. (Istanbul Technical Univ., Division of Machinery and Dynamics, Mechanical Engineering Department, Istanbul (Turkey); Istanbul Technical Univ. (Turkey). Inst. for Nuclear Energy; Istanbul Technical Univ., Division of Nuclear Power, Faculty of Electrical and Electronics Engineering, Istanbul (Turkey); Marmara Univ., Division of Electronics, Faculty of Technical Education, Istanbul (Turkey)). 1988. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705189/JAW. (CONF-8809213—).

From IAEA Meeting: 10th European TRIGA users' conference; Vienna, Austria (14 Sep 1988).

11059 (INIS-mf—11332, pp 46) **Analytical approach to the reactivity void coefficient of ITU Triga Mark 2 reactor.** Erdinc, E.; Tolga, Y. (Istanbul Technical Univ. (Turkey). Inst. for Nuclear Energy; Anadolu Science and Technology Strategies Research Institute). 1988. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705189/JAW. (CONF-8809213—).

From IAEA Meeting: 10th European TRIGA users' conference; Vienna, Austria (14 Sep 1988).

11060 (INIS-mf—11332, pp 45) **Criticality calculations for the Triga Mark 2 reactor of ITU by the finite element and the finite difference methods.** Oezgener, H.A. (Technical Univ. Istanbul, Istanbul (Turkey)). 1988. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705189/JAW. (CONF-8809213—).

From IAEA Meeting: 10th European TRIGA users' conference; Vienna, Austria (14 Sep 1988).

11061 (INIS-mf—11332, pp 44) **Measurement of new core characteristics at the Musashi reactor.** Nozaki, T.; Horiuchi, N.; Aizawa, O.; Matsumoto, T.; Sato, T. (Musashi Inst. of Tech., Kawasaki, Kanagawa (Japan). Atomic Energy Research Lab.). 1988. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705189/JAW. (CONF-8809213—).

From IAEA Meeting: 10th European TRIGA users' conference; Vienna, Austria (14 Sep 1988).

11062 (INIS-mf—11332, pp 47) **Study of the space dependency effect with feedback, throughout a rod ejection transient.** Erdinc, E. (Istanbul Technical Univ. (Turkey). Inst. for Nuclear Energy). 1988. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705189/JAW. (CONF-8809213—).

From IAEA Meeting: 10th European TRIGA users' conference; Vienna, Austria (14 Sep 1988).

11063 (INIS-mf—11332, pp 40) **Use of the Triga Mark 2 reactor, Ljubljana, Yugoslavia in the k/sub O/-method of NAA.** Smodis, B.; Jacimovic, R.; Stegnar, P.; Jovanovic, S.; Vukotic, P. (Institut Jozef Stefan, Ljubljana (Yugoslavia); Univ. 'V. Vlahovic', Titograd (Yugoslavia)). 1988. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705189/JAW. (CONF-8809213—).

From IAEA Meeting: 10th European TRIGA users' conference; Vienna, Austria (14 Sep 1988).

11064 (INIS-mf—11332, pp 28) **Stationary neutron radiography system: a Triga-based production neutron radiography facility.** Chesworth, R.H.; Hagmann, D.B. (GA Technologies, Inc., San Diego, CA (USA)). 1988. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705189/JAW. (CONF-8809213—).

From IAEA Meeting: 10th European TRIGA users' conference; Vienna, Austria (14 Sep 1988).

11065 (INIS-mf—11332, pp 29) **Modernization design of neutron radiography of ITU Triga Mark-2 reactor.** Tugrul, B.; Bilge, A.N. (Istanbul Technical Univ. (Turkey). Inst. for Nuclear Energy). 1988. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705189/JAW. (CONF-8809213—).

From IAEA Meeting: 10th European TRIGA users' conference; Vienna, Austria (14 Sep 1988).

11066 (INIS-mf—11332, pp 31) **Related work on neutron radiography and determination of neutron beam characteristics at Triga Mark 2 of ITU.** Tekin, M. (Technical Univ. Istanbul, Dept. of Physics, Istanbul (Turkey)). 1988. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705189/JAW. (CONF-8809213—).

From IAEA Meeting: 10th European TRIGA users' conference; Vienna, Austria (14 Sep 1988).

11067 **(KURRI-TR—305) Proceedings of the seminar on reactor physics experiments with critical assemblies.** Nishina, Kojiro; Kanda, Keiji; Shiroya, Seiji (eds.). (Kyoto Univ., Kumatori, Osaka (Japan). Research Reactor Inst.). 26 Nov 1987. 76p. (In Japanese). (CONF-8711251—). NTIS (US Sales Only), PC A05/MF A01 - OSTI. Order Number DE89003363/JAW.

From Seminar on reactor physics experiments with critical assemblies; Kyoto, Japan (26 Nov 1987).

The present issue is the proceedings of the "Seminar on Reactor Physics Experiments with Critical Assemblies," held at Kyoto University Research Reactor Institute (KURRI) on November 26, 1987. In the Seminar, members from almost all critical assemblies over Japan were asked to report on their recent accomplishments and research activities. The presentations in the Seminar turned out to cover a wide variety of subjects as seen in the program of the meeting. It included (1) the efforts to improve light-water reactor performance, (2) basic experiments related to the development of high-conversion light-water reactors, (3) criticality safety research closely related to the present stage of domestic nuclear fuel cycle endeavor, (4) basic experiments for high-temperature gas-cooled reactors, (5) measurements of void reactivity coefficient in a core simulating an advanced thermal converter, and (6) criticality experiments of medium-enriched uranium core. It covered such a variety that even the time allowed for presentations was felt to be too short for audience to digest the presented materials.

2207 Plutonium And Isotope Production Reactors

REFER ALSO TO CITATION(S) 11014, 11063, 11140

11068 **(CONF-880911—25) Advanced methods comparisons of reaction rates in the Purdue Fast Breeder Blanket Facility.** Hill, R.N.; Ott, K.O. (Argonne National Lab., IL (USA)). 1988. Contract W-31109-ENG-38. 13p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89003887/JAW.

From International reactor physics conference; Jackson Hole, WY, USA (18 Sep 1988).

A review of worldwide results revealed that reaction rates in the blanket region are generally underpredicted with the discrepancy increasing with penetration; however, these results vary widely. Experiments in the large uniform Purdue Fast Breeder Blanket Facility (FBBF) blanket yield an accurate quantification of this discrepancy. Using standard production code methods (diffusion theory with 50 group cross sections), a consistent Calculated/Experimental (C/E) drop-off was observed for various reaction rates. A 50% increase in the calculated results at the outer edge of the blanket is necessary for agreement with experiments. The usefulness of refined group constant generation utilizing specialized weighting spectra and transport theory methods in correcting this discrepancy was analyzed. Refined group constants reduce the discrepancy to half that observed using the standard method. The surprising result was that transport methods had no effect on the blanket deviations; thus, transport theory considerations do not constitute or even contribute to an explanation of the blanket discrepancies. The residual blanket C/E drop-off (about half the standard drop-off) using ad-

vanced methods must be caused by some approximations which are applied in all current methods. 27 refs., 3 figs., 1 tab.

11069 (DPST—88-951) Cost estimates: Stress improvement remedies for Savannah River reactor process water pipe welds. Caskey, G.R.; Vormelker, P.R.; Ehrhart, W.S. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). 15 Nov 1988. Contract AC09-76SR00001. 5p. NTIS, PC A02/MF A01 - OSTI. Order Number DE89004843/JAW.

The process water pipes in the Savannah River reactors were made of Type 304 stainless steel. This steel becomes susceptible to intergranular stress corrosion cracking (IGSCC) when sensitized as by welding. IGSCC may initiate in locations under residual or applied tensile stress in the presence of impure water such as the moderator. One recommendation from the 1986 ES & H audit was for further evaluation of the application of stress improvement (SI), either induction heating stress improvement (HSI) or heat sink welding (HSW), to preclude further cracks and leaks in susceptible welds in the process water piping. In our response to this ES & H recommendations, we stated that there was no safety reason to consider such action, but that we would evaluate the operational cost-benefit of remedial treatment of the welds. Mechanical stress improvement (MSIP), weld overlay (WO) and Pipelock were evaluated also. All of the welds in the process water systems which join Type 304 stainless steel are potential sites for IGSCC. Therefore, any of the approved treatments would be of potential benefit by eliminating or reducing the tensile stress necessary for IGSCC. 9 refs., 3 tabs.

2209 Reactor Safety

REFER ALSO TO CITATION(S) 10995, 11004, 11006, 11013, 11017, 11030, 11035, 11036

11070 (BARC—1383) Earthquake problem in engineering design: generating earthquake design basis information. Sharma, R.D. (Bhabha Atomic Research Centre, Bombay (India). Seismology Section). (Bhabha Atomic Research Centre, Bombay (India)). 1987. 42p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704076/JAW.

Designing earthquake resistant structures requires certain design inputs specific to the seismotectonic status of the region, in which a critical facility is to be located. Generating these inputs requires collection of earthquake related information using present day techniques in seismology and geology, and processing the collected information to integrate it to arrive at a consolidated picture of the seismotectonics of the region. The earthquake problem in engineering design has been outlined in the context of a seismic design of nuclear power plants vis a vis current state of the art techniques. The extent to which the accepted procedures of assessing seismic risk in the region and generating the design inputs have been adherred to determine to a great extent the safety of the structures against future earthquakes. The document is a step towards developing an aproach for generating these inputs, which form the earthquake design basis.

11071 (CEA-N—2574) Experimental study of the solubilization of various elements likely to be emitted following a serious accident on a pressurized water reactor (P.W.R.). Monfort, M.; Picat, P.; Cartier, Y. (CEA Centre d'Etudes Nucleaires de Cadarache, 13 - Saint-Paul-lez-Durance (France)). Sep 1988. 21p. (In French). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756235/JAW.

The solubility of various constituents (Ru0/sub 2/, Ce0/sub 2/, Ag, In/sub 2/0/sub 3/, Fe/sub 2/0/sub 3/) of aerosols released into the environment following a serious accident at a PWR have been studied using four types of natural waters (rain water and soil solutions). Very small quantities of each of the products studied pass into solution. The soluble fraction of Ru0/sub 2/, composed of microparticles of oxide, appears to be more mobile in soils than that of Ag, consisting in part of Ag/sup +/ ions.

11072 (CONF-881011—34) Spreading of molten corium in Mk I geometry following vessel meltthrough. Sienicki, J.J.; Farmer, M.T.; Spencer, B.W. (Argonne National Lab., IL (USA)). [1988]. Contract W-31109-ENG-38. 12p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89003973/JAW.

From Joint meeting of the European Nuclear Society and the American Nuclear Society; Washington, DC, USA (30 Oct 1988).

A one-dimensional, multicell, Eulerian computer code is under development to predict the gravity-driven spreading dynamics and thermal interactions of a molten corium layer flowing horizontally over a concrete substrate. The code is compared to recent experiments in which molten mixtures of iron and aluminum oxide flowed over concrete in the presence and absence of water. Results are presented from scoping calculations for the Mk I BWR system investigating the spreading-induced penetration immediately following the drainage of a predominantly oxide molten corium mixture from a localized breach in the reactor vessel. 12 refs., 7 figs.

11073 (CONF-8810155—28) The Integral Fast Reactor. Chang, Y.I. (Argonne National Lab., IL (USA)). 1988. Contract W-31109-ENG-38. 8p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004290/JAW.

From 16. water reactor safety information meeting; Gaithersburg, MD, USA (24 Oct 1988).

The Integral Fast Reactor (IFR) is an innovative liquid metal reactor concept being developed at Argonne National Laboratory. It seeks to specifically exploit the inherent properties of liquid metal cooling and metallic fuel in a way that leads to substantial improvements in the characteristics of the complete reactor system. This paper describes the key features and potential advantages of the IFR concept, with emphasis on its safety characteristics. 3 refs., 4 figs., 1 tab.

11074 (DOE/ID—10211) Analysis of a high pressure ATWS [anticipated transient without scram] with very low make-up flow. Wagner, K.C. (EG and G Idaho, Inc., Idaho Falls (USA)). Oct 1988. Contract AC07-76ID01570. 51p. (MISC—88130). NTIS, PC A04/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004874/JAW.

A series of calculations were performed to analyze the response of General Electric Company's (GE) advanced boiling water reactor (ABWR) during an anticipated transient without scram (ATWS). This work investigated the early plant response with an assumed failure or manual inhibit of the high pressure core flooder (HPCF). Consequently, the reactor core isolation cooling (RCIC) and control rod drive (CRD) systems are the only sources of high pressure injection available to maintain core cooling. Steam leaving the reactor pressure vessel was diverted to the pressure suppression pool (PSP) via the steam line and the safety relief valves. The combination of an unscrammed core and the CRD and RCIC injection sources make this a particularly challenging transient. System energy balance calculations were performed to predict the core power and PSP heat-up rate. The amount of vessel vapor superheat and the PSP temperature were found to significantly affect the resultant core power. Consequently, detailed thermal-hydraulic calculations were performed to simulate the system response during the postulated transient. 15 refs., 15 figs., 4 tabs.

11075 (EGG-M—88294) Early results of gate valve flow interruption blowdown tests. DeWall, K.G. (EG and G Idaho, Inc., Idaho Falls (USA)). 1988. Contract AC07-76ID01570. 23p. (CONF-8810155—32). NTIS, PC A03/MF A01 - OSTI; GPO Dep. Order Number DE89005288/JAW.

From 16. water reactor safety information meeting; Gaithersburg, MD, USA (24 Oct 1988).

The preliminary results of the USNRC/INEL high-energy BWR line break flow interruption testing are presented. Two representative nuclear valve assemblies were cycled under design basis Reactor Water Cleanup pipe break conditions to provide input for the technical basis for resolving the Nuclear Regulatory Commission's Generic Issue 87. The effects of the blowdown hydraulic loadings on valve operability, especially valve closure stem forces, were studied. The blowdown tests showed that, given enough thrust, typical gate valves will close against the high flow

resulting from a line break. The tests also showed that proper operator sizing depends on the correct identification of values for the sizing equation. Evidence exists that values used in the past may not be conservative for all valve applications. The tests showed that improper operator lock ring installation following test or maintenance can invalidate in-situ test results and prevent the valve from performing its design function. 2 refs., 12 figs., 2 tabs.

11076 (EPRI-NP—5781-SR, pp 1.1-1.26) **Overview of 1986-1987 RETRAN activity.** Agee, L.J. Apr 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88010466/JAW. (CONF-8711152—).

From 5. international RETRAN meeting; Boston, MA, USA (9 Nov 1987).

A review is presented of the major RETRAN-related activities which have occurred over the past two years. These activities fall into two broad areas: 1) the use of RETRAN-02 by the nuclear industry; and 2) the development, verification and validation of RETRAN-03. Both of these subjects will be discussed and the new and different applications of RETRAN briefly indicated.

11077 (EPRI-NP—5781-SR, pp 2.1-2.8) **Issues regarding transient analysis a utility perspective.** Bergeron, P.A. (Yankee Atomic Electric Company, Framingham, MA (USA)). Apr 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88010466/JAW. (CONF-8711152—).

From 5. international RETRAN meeting; Boston, MA, USA (9 Nov 1987).

Analysis predicting the transient behavior of a nuclear power plant has been a significant aspect of the licensing process. The final safety analysis report (FSAR), supporting the licensing basis for each operating reactor, contains a section describing plant response to a wide range of postulated transients. These analyses demonstrate that the plant can be operated safely, without exceeding certain prescribed limits for the various event categories. For each core reload, the FSAR licensing basis analyses are reviewed, in some cases reanalyzed, to address the impact of the reconfigured core. In addition to supporting the core reload licensing, transient analysis methods have been used to provide input to a wide variety of activities. These activities range anywhere from evaluating transient behavior during plant maneuvers to performing detailed analysis evaluating potential safety issues. Transient analysis needs vary depending upon the issue being addressed. One utility's experience in performing transient analysis in support of operating reactors is presented. The experience spans approximately 14 years starting in the early 1970s to the present. Specific issues that have been treated using transient analysis methods will be described along with the level of detail required in the analysis. Trends in analysis needs will be reflected. These trends will be used to project future needs.

11078 (EPRI-NP—5781-SR, pp 3.1-3.14) **Issues regarding transient analysis examined by the Sizewell B Public Inquiry.** Farmer, P.R.; Dunnicliffe, C.J. (Central Electricity Generating Board, Marchwood, Southampton (England)). Apr 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88010466/JAW. (CONF-8711152—).

From 5. international RETRAN meeting; Boston, MA, USA (9 Nov 1987).

Issues on PWR safety transient analysis that were discussed at the Sizewell B Public Inquiry are presented. The Public Inquiry was set up by the UK Government under an Inspector, Sir Frank Layfield, to examine all aspects of the construction, safety and operation of a 1200 MW(e) PWR on the Sizewell site. The terms of reference were broad ranging, and the constitution of the Inquiry was to make a recommendation under three Acts of Parliament which apply to the construction and operation of nuclear electrical plant. The Inquiry also covered local planning aspects, which are the responsibility of the Local Authority - in this case the Suffolk County Council. The Inspector examined and made recommendations on the safety of the Station, but consideration by Public Inquiry is outside the formal safety and licensing process, which is the business of the Utility (the CEGB) and the Nuclear Installations Inspectorate (the NII). The paper therefore takes a broader look at the question of safety, dealing with the licensing process, the requirements of the safety case and the forward strategies adopted by the CEGB in terms of research and development. This is considered for transient analysis, and the aim is to set the discussions and conclusions of the Public Inquiry into their proper context with regard to nuclear safety in the UK. The Inquiry went into some depth on the topic of LOCA, as an example of safety analysis. In the summary of the evidence and cross-examination the Inspector accepted the adequacy of the LOCA safety case without major reservations, and was satisfied further work in progress would resolve any residual criticisms. In particular support was given for the CEGB commitment to the development and use of more physically realistic calculational methods.

11079 (EPRI-NP—5781-SR, pp 4.1-4.10) **Issues regarding transient analysis.** Duffey, R.B. (EG & G Idaho, Incorporated, Idaho Falls, ID (USA)). Apr 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88010466/JAW. (CONF-8711152—).

From 5. international RETRAN meeting; Boston, MA, USA (9 Nov 1987).

This paper discusses the evolution and reevolution in transient analysis that has been and is occurring. From strictly design basis transients and the determination of margins and setpoints, emphasis continues to shift to risk-dominant sequences and the importance of equipment reliability and operator actions. The importance simulation in training, procedure development and accident management follows form these developments. The increase is computer power per dollar places the issue of how best to utilize large mainframe codes in sharper focus.

11080 (EPRI-NP—5781-SR, pp 5.1-5.4) **Thermal-hydraulic considerations in nuclear power plant license renewal.** Sheron, B.W. (Nuclear Regulatory Commission, Washington, DC (USA)). Apr 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88010466/JAW. (CONF-8711152—).

From 5. international RETRAN meeting; Boston, MA, USA (9 Nov 1987).

A major issue looming in the future for both the NRC and the regulated industry is the matter of license renewal. This is the renewal of licenses beyond the current 40 year plant life (not to be confused with license extension involving moving the start date of the 40 year life from the CP issuance to the OL issuance). While it is too early to speculate as to what shape the license renewal policy and regulations will take, it is not too early to conclude that each licensee will have to demonstrate why its plant can operate safely beyond 40 years. Exactly how this demonstration must be made is the subject of an extensive policy development program and rulemaking process at the NRC. There are certain areas of thermal hydraulic analysis that may be important to license renewal. These are 1) Pressurized Thermal Shock to Pressure Vessels, 2) Management of Severe Accidents, 3) Plant Simulators, and 4) Transient Histories. Each of these is briefly discussed.

11081 (EPRI-NP—5781-SR, pp 6.1-6.48) **RETRAN application for issue resolution.** Chexal, V.K.; Chao, J.; Agee, L.J.; Layman, W.H.; Jensen, P.J. Apr 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88010466/JAW. (CONF-8711152—).

From 5. international RETRAN meeting; Boston, MA, USA (9 Nov 1987).

The Nuclear Safety Analysis Center (NSAC) at the Electric Power Institute (EPRI) has a Generic Safety Analysis Program to help resolve high priority safety issues. This paper describes several high priority safety issues considered at NSAC that were resolved at least in part through the use of the RETRAN computer code. These issues are pressurized thermal shock (PTS), anticipated transients without scram (ATWS) in both PWRs and BWRs, steam generator tube rupture (SGTR), and scram frequency reduction.

11082 (EPRI-NP—5781-SR, pp 7.1-7.30) **Features of the RETRAN-03 computer code.** Paulsen, M.P.; Griebenow, B.E.; Feinauer, L.R.; McFadden, J.H.; Jensen, P.J. (EI International, Incorporated, Idaho Falls, ID (USA)). Apr 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88010466/JAW. (CONF-8711152—).

From 5. international RETRAN meeting; Boston, MA, USA (9 Nov 1987).

The RETRAN-02 computer code has been used extensively to analyze operational transients and small break loss-of-coolant accidents. While results of these analyses are generally in good agreement with data, there are various theoretical and practical limitations associated with RETRAN-02. The RETRAN-03 code development effort is designed to ease or overcome these limitations. This paper presents a summary of the objectives of the RETRAN-03 development project and a review of the model development tasks planned for the code. The numerical solution methods for the steady-state and transient equations, an improved control system solution, the general transport model and the field equation options in the code are discussed along with some analyses results various prerelease versions of RETRAN-03.

11083 (EPRI-NP—5781-SR, pp 8.1-8.24) **Using RETRAN to develop a BWR transient diagnostic expert system.** Yoshida, K.; Naser, J. Apr 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88010466/JAW. (CONF-8711152—).

From 5. international RETRAN meeting; Boston, MA, USA (9 Nov 1987).

Expert system technology has matured enough to offer considerable promise for a number of application areas in the electric utility industry. The number of efforts going on in the industry demonstrates that the potential of expert systems is widely recognized. One possible application is to aid the power plant operators in determining the type and cause of a transient. This information will assist the operator in determining the proper response to the transient. In order to develop a transient diagnostic expert system, it is essential to create a knowledge base which contains the time-varying characteristics of the transients for which the diagnostic system is applicable. Two major sources exist for the development of this knowledge base. The first are actual plant data and the second are the results of simulation codes like RETRAN.

11084 (EPRI-NP—5781-SR, pp 9.1-9.16) **RETRAN analyses of power excursion event in Chernobyl accident.** Tanabe, F.; Yoshida, K.; Hirano, M.; Kohsaka, A. (Japan Atomic Energy Research Institute, Ibaraki-ken). Apr 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88010466/JAW. (CONF-8711152—).

From 5. international RETRAN meeting; Boston, MA, USA (9 Nov 1987).

The accident at the Chernobyl-4 reactor in USSR on April 26, 1986 has given serious impact all over the world. Although an outline of causes, sequence and consequences of the accident has been reported by USSR(2), enough information has been given for full understanding in detail. In order to obtain profounder understanding of the accident, analysis of the power excursion event in the accident were performed. The items analyzed in the present work are thermal hydraulic behavior of the primary loop, power excursion behavior and fuel rods thermal behavior, and analyses are made for the portion after the beginning of the experiment with closure of main stream valve to turbine at 1:23:04 on April 26.

11085 (EPRI-NP—5781-SR, pp 10.1-10.32) **Analysis of the Chernobyl accident using RETRAN 02/MOD3.** Chao, J.; Chexal, B.; Layman, W.; Vine, G.; Jensen, P.; Dastur, A. Apr 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88010466/JAW. (CONF-8711152—).

From 5. international RETRAN meeting; Boston, MA, USA (9 Nov 1987).

The two power peaks during the Chernobyl accident reported by the Soviets were analyzed using the RETRAN code. The time and the magnitude of the first power peak predicted by the RETRAN model compared well with the data presented by the Soviets. The analysis also revealed that one of the possible contributing factors to the second power peak was the depressurization of the system due to the rupture of the pressure boundary caused by the first power peak. The depressurization of the system generated more void, resulting in additional reactivity insertion which produced a second peak. A parametric study showed that the positive reactivity introduced by the scram rods and the reactivity caused by the positive void coefficient were both important in contributing to the accident.

11086 (EPRI-NP—5781-SR, pp 11.1-11.17) **Vectorization of RETRAN-03 on the IBM 3090 vector facility.** Millerd, G.H.; Fasano, J.P.; Singh, U.N.; Williams, M.A.; Lawrence, R.D. (IBM Corporation, Kingston, NY (USA)). Apr 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88010466/JAW. (CONF-8711152—).

From 5. international RETRAN meeting; Boston, MA, USA (9 Nov 1987).

The development of a vectorized version of the RETRAN-03 code for the IBM 3090 Vector Facility is described. Results of an execution analysis identifying CPU-intensive areas of the code are summarized. Vectorization techniques such as restructuring of DO-loops and the use of list vectors to minimize conditional branching are applied in four CPU-intensive sections of the code; the pressure calculation, the energy calculation, the computation of the junction properties, and the generation and solution of the discretized conservation equations. Performance comparisons obtained to date between the original scalar code and the preliminary vectorized version are given.

11087 (EPRI-NP—5781-SR, pp 12.1-12.14) **Independent safety analysis - why us? - A perspective from TU electric.** Rice, B.L.; Boatwright, W.J.; De Vore, C.V.; Lo, S.S.; Maier, S.M. (TU Electric, Dallas, TX (USA)). Apr 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88010466/JAW. (CONF-8711152—).

From 5. international RETRAN meeting; Boston, MA, USA (9 Nov 1987).

The development of a plant transient analysis capability at TU Electric was initiated in 1982 for Comanche Peak operations support. This type of support was available from the NSSS vendor, but the timeliness and cost of vendor responses to requests for services become a concern. RETRAN-02 MOD002 was acquired at that time for developing a best estimate model of Comanche Peak Unit 1. The activities of the Transient Analysis Section have evolved to a point where operations support is no longer the primary activity. RETRAN is also being used for the development of reload licensing methods and the resolution of licensing concerns raised internally or by the Nuclear Regulatory Commission (NRC). Future uses of RETRAN include simulator certification, as required by Regulatory Guide 1.149, and Justifications for Continued Operation for the plants. Benefits similar to those experienced through the RETRAN activities are expected in the following areas currently being developed: core thermal-hydraulics, fuel performance, LOCA, and systems analysis (PRA and reliability analysis). The major benefit expected from these activities is the development of a thorough understanding of plant operations and the in-house ability to handle operations and licensing questions, concerns and problems in a timely and cost effective manner.

11088 (EPRI-NP—5781-SR, pp 13.1-13.16) **Results of CP & L analysis of Brunswick unit 1 startup tests using RETRAN.** Ganthner, S.J.; Wenger, A.F. (Carolina Power & Light Company, Raleigh, NC (USA)). Apr 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88010466/JAW. (CONF-8711152—).

From 5. international RETRAN meeting; Boston, MA, USA (9 Nov 1987).

RETRAN models for the two-unit BWR/4 Brunswick Steam Electric Power Plant have been under development by Carolina Power & Light Company (CP & L) since 1981 with the ultimate objective of obtaining Nuclear Regulatory Commission (NRC) approval to perform reload cycle transient licensing analyses. While attainment of this goal remains several years in the future, these models have been useful in the evaluation of operational occurrences and in the conduct of design reviews of vendor analyses. Qualification of the Brunswick Unit 1 model against five initial cycle startup tests has been completed. These test include a turbine trip, a single feed pump trip, a level setpoint change, and single and double recirculation pump trips. A description of the interface code PETRA and the methods used to generate and collapse the PRESTO three-dimensional neutronics parameters for use with one-dimensional RETRAN models is presented. This is followed by comparisons of calculated and measured values of key pa-

rameters for each of the five initial startup tests used to qualify the Brunswick Unit 1 RETRAN model.

11089 (EPRI-NP—5781-SR, pp 14.1-14.19) **Pressurizer models for loft experiment LP-FW-1.** Birchley, J.; Newbon, S. (United Kingdom Atomic Energy Authority, Dorset (England)). Apr 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88010466/JAW. (CONF-8711152—).

From 5. international RETRAN meeting; Boston, MA, USA (9 Nov 1987).

The primary system pressure response in all operational and fault transients is largely determined by the flow into or out of the pressurizer, and by the functional response of the pressure control systems (spray, PORV, etc) and the processes that take place within the pressurizer. It is important that these processes be adequately modeled if the pressure response, and hence the ensuing transient are to be correctly calculated. The present study investigates the RETRAN-02/MOD 4 representation of pressurizer behavior during the early stages of the OECD LOFT loss of feedwater experiment LP-FW-1. Attention is focused on the pressurizer itself by treating the surge line flow as a boundary condition. Sensitivity studies are performed to evaluate the importance of the following processes: heat transfer to/from the pressurizer walls; heat transfer between the vapor and liquid regions; thermal stratification in the liquid region; and desuperheating and condensation of the vapor by the spray.

11090 (EPRI-NP—5781-SR, pp 15.1-15.18) **Qualification of a RETRAN 02 model for cofrentes.** Martinez, J.J.; Sedano, P.G. (UITESA, Madrid (Spain)). Apr 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88010466/JAW. (CONF-8711152—).

From 5. international RETRAN meeting; Boston, MA, USA (9 Nov 1987).

A RETRAN-02 model has been developed for C.N. Cofrentes, a Spanish BWR-6 plant, during these last years. The model consists of 38 volumes, 51 junctions, and 12 conductors, incorporating the main control systems: pressure control, level control and recirculation control. After the completion, the main objective was to validate the model, in order to have an effective and reliable tool for future applications. Since C.N. Cofrentes has an ERIS Station, this powerful system has been used to record plant data during the preoperational and start-up tests. The RETRAN-02 model was used to reproduce the plant transients and through the specific test, each one of the code models has been validated. The operational transients include: setpoint changes in recirculation, pressure and level control systems, recirculation pump trips, feedwater pump trips, turbine trips, main steam isolation.

11091 (EPRI-NP—5781-SR, pp 16.1-16.13) **RETRAN analysis of Rancho Seco's overcooling incident.** Choe, W.G.; Chiang, A. Apr 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88010466/JAW. (CONF-8711152—).

From 5. international RETRAN meeting; Boston, MA, USA (9 Nov 1987).

A thermal-hydraulic analysis of Rancho Seco's overcooling incident that occurred on December 26, 1985 was performed using the reactor system thermal-hydraulic computer code, RETRAN-02 MOD 003 (1). Homogeneous and dynamic slip options were tested and sensitivity studies for steam generator nodalization were performed to find out the code's limitations on the auxiliary feedwater flow for Once-Through Steam Generator (OTSG).

11092 (EPRI-NP—5781-SR, pp 17.1-17.26) **Loss of residual heat removal LTOP analysis using RETRAN-02.** Fujita, N.; Palmer, S. (Yankee Atomic Electric Company, Framingham, MA (USA)). Apr 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88010466/JAW. (CONF-8711152—).

From 5. international RETRAN meeting; Boston, MA, USA (9 Nov 1987).

The pressure-temperature operating limits derived from 10CFR, Part 50, Appendix G are used as an acceptance criteria in the analysis of Low Temperature Overpressurization (LTOP) events. During an LTOP event, the combination of system pressure and temperature could potentially exceed the P-T limits. LTOP protection is provided to reduce the likelihood that this would occur. The LTOP analysis for Yankee Nuclear Power Station includes several postulated events which are classified as mass and/or energy addition events. Among the events analyzed, the loss of Residual Heat Removal (RHR) event was found to be one of the most complicated to calculate, requiring a system level analysis to predict the overall heatup. Analyses were performed using the RETRAN Code. A loss of RHR capacity may cause excessive heating of the reactor coolant due to decay heat, resulting in overpressurization.

11093 (EPRI-NP—5781-SR, pp 18.1-18.22) **High pressure setpoint changes to the Oyster Creek Nuclear Generating Station.** Trikouros, N.; Sorensen, J.; Engel, R. (GPU Nuclear Corporation, Parsippany, NJ (USA)). Apr 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88010466/JAW. (CONF-8711152—).

From 5. international RETRAN meeting; Boston, MA, USA (9 Nov 1987).

GPU Nuclear Corporation (GPUNC) intends to modify the Oyster Creek Nuclear Generation Station high reactor pressure setpoints to allow an increased margin for setpoint drift experienced during plant operation. Justification of the proposed Technical Specification changes requires consideration of both licensing basis assumptions and plant performance criteria. The license basis analysis process is deterministic in that conservative values are chosen for the model input parameters. All license basis events whose effect on plant response is influenced by the proposed setpoint modification must be identified and evaluated to demonstrate the acceptability of the desired new setpoints. This paper discusses the Statistical Combination of Uncertainties (SCU) process and the RETRAN analyses performed to assure that the plant performance criteria are not violated by the modified setpoints.

11094 (EPRI-NP—5781-SR, pp 19.1-19.16) **RETRAN analysis of Safety Relief Valve setpoint - drift and tolerance evaluation for BWRs.** Szwarc, K. (New York Power Authority, NY (USA)). Apr 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88010466/JAW. (CONF-8711152—).

From 5. international RETRAN meeting; Boston, MA, USA (9 Nov 1987).

This study presents implications and guidelines for safety evaluations of Safety Relief Valve setpoint drift in a GE BWR/4 design reactor. The problem was investigated using the RETRAN02MOD003 code. The analysis demonstrated that margin to the safety limit pressure is maintained even for the extreme case of one SRV out-of-service with the remaining actuating at 5% above setpoint pressure.

11095 (EPRI-NP—5781-SR, pp 20.1-20.16) **Simulation of McGuire and Catawba transient data and qualification of RETRAN plant model.** Lee, H.J.; Henshaw, M.E.; Goodwin, P.A.; Johnson, R.S. (Duke Power Company, Charlotte, NC (USA)). Apr 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88010466/JAW. (CONF-8711152—).

From 5. international RETRAN meeting; Boston, MA, USA (9 Nov 1987).

An extensive effort has been made at Duke Power Company to construct and qualify an RETRAN-02 MOD003(1) model capable of simulating the transient response of the McGuire and Catawba Nuclear Stations. The product of this effort is a collection of unit-specific plant models capable of simulating operational transients and, with suitable modification, of being used for FSAR Chapter 15 non-LOCA transient analysis. The four transients presented in this paper were selected from eight comparison transients submitted by Duke to the NRC in a topical report(2) to demonstrate the adequacy of the transient analysis methodology. These transients were selected to give as wide a variation as possible with respect to event type, subject to the availability of adequate comparison data. The events described here are a partial loss of secondary heat sink, an overcooling event with delayed safety injection, a loss of offsite power, and a turbine trip from intermediate power with reactor runback.

11096 (EPRI-NP—5781-SR, pp 21.1-21.22) **Comparison between RETRAN-02 and RETRAN-03 for transient analysis.** De Vore, C.V.; Maier, S.M. (TU Electric, Dallas, TX (USA)). Apr 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88010466/JAW. (CONF-8711152—).

From 5. international RETRAN meeting; Boston, MA, USA (9 Nov 1987).

A comparison between the transient thermal-hydraulic codes, RETRAN-02 and RETRAN-03, was derived from a Texas Utilities (TU) Electric Reactor Engineering Department project. The purpose of the project was to provide RETRAN analyses for eleven (11) transients to be used to benchmark the Comanche Peak Steam Electric Station (CPSES) plant simulator. These analyses are useful in developing, correcting, and validating plant simulator models. In the absence of actual plant data, the RETRAN analyses provide the best available estimate of actual plant performance. For each of the eleven transients, RETRAN analysis was performed to generate data for a number of plant parameters to be compared with the plant simulator. RETRAN-03, which is currently in prerelease status, was the primary code used for the simulator benchmark effort. RETRAN-02 MOD004 was used to perform selected comparisons with RETRAN-03 PRE35 analyses for five of the analyzed transients to provide added confidence in the RETRAN-03 results. The objective of the comparison is to show the degree of consistency between the two RETRAN codes and to provide verification for the RETRAN-03 code.

11097 (EPRI-NP—5781-SR, pp 22.1-22.17) **Pre-test prediction for a LOBI-MOD2 large steam line break.** Lightfoot, P.; Birchley, J.; Rogers, J. (CEGB, Southampton, Hampshire (England)). Apr 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88010466/JAW. (CONF-8711152—).

From 5. international RETRAN meeting; Boston, MA, USA (9 Nov 1987).

The LOBI-MOD2 Integral Test Facility located at Ispra in Italy provides an electrically heated 1:712 volume scaled full height representation of a 1300 MWe PWR plant. The facility features heavily instrumented steam generators and has been designed for small break LOCA and pressurized fault studies. Recently, a large steam line break test designated BT-12 was undertaken on LOBI-MOD2. The UK provided the test specification and performed a pre-test analysis. A total of three RETRAN-02 calculations were performed; one best estimate and two scoping. The scoping analyses were designed to minimize and maximize the primary cooldown by respectively maximizing and minimizing the carryover of liquid to the break. The experimental data is not yet available in its final form, but it is clear that the test results deviated substantially from the best estimate prediction. Complete blowdown required some 210 s as against a predicted 70 s, and the initial broken loop cold leg cooldown was 38 K compared with a predicted 16 K. The discrepancies result largely from an over-prediction of the liquid carryover to the break. It is argued that this arises from inadequate modeling of the separation processes. Specific improvements are recommended for the modeling of the separation processes for the detailed post test analysis.

11098 (EPRI-NP—5781-SR, pp 23.1-23.11) **Licensing applications and topical reviews of the RETRAN computer code.** Liang, C.Y.; Komoriya, H.; Abramson, P.B. (Nuclear Regulatory Commission, Washington, DC (USA)). Apr 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88010466/JAW. (CONF-8711152—).

From 5. international RETRAN meeting; Boston, MA, USA (9 Nov 1987).

On September 4, 1984, the US Nuclear Regulatory Commission (NRC) approved, contingent upon completion of correction of errors discovered in the review process, use of RETRAN-02/MOD002 for certain utility applications. Because this generic code review had not included review of plant specific applications, the approval was of the code only, and applicants are required to justify use of the code and its models on a plant and transient specific basis. During and following completion of the generic review, a number of utilities have submitted analyses requesting that the NRC approve the submittals for purposes ranging from simply demonstrating that the applicant was able to use the code, to detailed transient and accident analysis in the licensing arena. The NRC guidance for applicants consists primarily of Generic Letter 83-11 in which an applicant is broadly instructed to perform its own code verification and demonstrate its own technical competence. This broad guidance has led to a wide range of technical detail in submittals and therefore to a correspondingly broad spectrum of NRC approvals. This paper discusses the status of those applications, reviews the breadth of requests and, finally discusses issues that have arisen with respect to these applications.

11099 (EPRI-NP—5781-SR, pp 24.1-24.31) **Qualification of RETRAN for simulator applications.** Harrison, J.F. (WOTEC, Incorporated, Richmond, VA (USA)). Apr 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88010466/JAW. (CONF-8711152—).

From 5. international RETRAN meeting; Boston, MA, USA (9 Nov 1987).

The use of full-scope control room replica simulators increased substantially following the accident at Three Mile Island Unit 2. The technical capability required to represent severe events has been included, in varying degrees, in most simulators purchased since the TMI-2 accident. The ability of the instructor to create a large variety of combinations of malfunctions has also greatly expanded. The nuclear industry has developed a standard which establishes the minimum functional requirements for full-scope nuclear control room simulators used for operator training. This standard, ANSI/ANS-3.5, was first issued in 1981 and was reissued in 1985. A method for performing simulator qualification with best estimate analytical data has been proposed in EPRI NP-4243, Analytic Simulator Qualification Methodology. The idea presented there is to choose a set of transients which drive the simulator into all the system conditions (dynamic states) likely to be encountered during operator training. The key observable parameters for each state are compared to analyses performed with the best estimate analytical model The closeness of the comparison determines the fidelity of the simulator. The approach described in EPRI NP-4243 has been adapted for evaluating RETRAN's capability for use in simulator qualification. RETRAN analyses which compare the RETRAN results to plant or test facility data are evaluated with respect to the simulator test matrix documented in EPRI NP-4243.

11100 (EPRI-NP—5781-SR, pp 25.1-25.26) **RETRAN applications at Florida Power & Light to support operations and training.** Arpa, J.; Ramos, J.; Villar, J. (Florida Power & Light Company, Miami, FL (USA)). Apr 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88010466/JAW. (CONF-8711152—).

From 5. international RETRAN meeting; Boston, MA, USA (9 Nov 1987).

Three applications of the RETRAN code at Florida Power Light (FPL) to enhance plant operational margin and support training simulators are presented. Two of the applications are intended for increasing plant availability. One by reducing the frequency of unnecessary reactor trips on turbine trips during power ascension and the other, by providing a simple relationship between electrical frequency and reactor coolant flow. This relationship is then used in the selection of electrical load shedding schemes. The third application is in the area of training simulators where special RETRAN best estimate analyses have been used as part of the acceptance program for the FP & L simulators.

11101 (EPRI-NP—5781-SR, pp 26.1-26.13) **Qualification of the Oconee RETRAN model by comparison with plant transient data.** Nesbit, S.P.; Gerling, R.J.; Swindlehurst, G.B. (Duke Power Company, Charlotte, NC (USA)). Apr 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88010466/JAW. (CONF-8711152—).

From 5. international RETRAN meeting; Boston, MA, USA (9 Nov 1987).

The Duke Power Company uses the RETRAN code (1) extensively for thermal-hydraulic transient analyses of the Oconee Nuclear Station. These applications include emergency procedure enhancement, simulator validation, FSAR Chapter 15 reanalyses, and general licensing support. The original qualification work for

the Oconee Model consisted of several benchmarks which demonstrated the ability of the code and model to accurately predict plant transient behavior (2). As a part of the general safety analysis topical report (3) submitted by Duke to the NRC, the benchmarking work was revised and expanded. Nine plant transients were benchmarked, including seven which were not included in the original work. These events include the following range of transient types: loss of primary-to-secondary heat transfer, excessive primary-to-secondary heat transfer, loss of forced primary circulation, change in core reactivity, and operational transients without reactor trip. Four of these benchmarks are discussed.

11102 (EPRI-NP—5781-SR, pp 27.1-27.27) **Boron transport simulation using RETRAN control system models for anticipated transient without Scram (ATWS) analysis.** Guey, C.N.; Miller, J.S.; Howe, T.M. (Gulf States Utilities Company, St. Francisville, LA (USA)). Apr 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88010466/JAW. (CONF-8711152—).

From 5. international RETRAN meeting; Boston, MA, USA (9 Nov 1987).

This paper presents the results of Anticipated Transient Without Scram (ATWS) analyses performed for River Bend Station (RBS). RBS is a Boiling Water Reactor/6 (BWR/6) with 624 fuel assemblies and an inside reactor vessel diameter of approximately 218 inches. During postulated ATWS events, important operator actions and system design considerations, among other things, include: (1) stand pipe lower plenum injection effectiveness, (2) water level control, (3) enrichment of Boron-10, (4) ability to maintain adequate suppression pool temperature within the limits based on heat capacity considerations, and (5) ability to maintain and achieve the cold shutdown conditions. This work considers the first four items for RBS ATWS analysis by incorporating a new boron transport model in the RBS RETRAN model that represents a more realistic analysis based on local mass balance of the boron between each volume and its adjacent neighboring volumes.

11103 (EPRI-NP—5781-SR, pp 28.1-28.19) **Comparison of RETRAN-02 MOD3 and RETRAN-03 PRE36 against Palo Verde Nuclear Generating Station Plant data for a loss of feedwater pump test.** Webb, J.R. (Arizona Nuclear Power Plant, Phoenix (USA)). Apr 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88010466/JAW. (CONF-8711152—).

From 5. international RETRAN meeting; Boston, MA, USA (9 Nov 1987).

As a member of the EPRI RETRAN-03 Prerelease User Group, Arizona Nuclear Power Project undertook a comparison of the available version of RETRAN-03 (Prerelease Version 36) with RETRAN-02 MOD3. The RETRAN model of a Palo Verde Nuclear Generating Station reactor plant was utilized for the comparison. A loss of feedwater pump transient was selected due to the availability of recorded data from startup testing of Palo Verde Unit 1. The purpose of the comparison was to answer the following questions: Do RETRAN-02 and RETRAN-03 provide the same solution given identical input? and How much faster is the RETRAN-03 implicit solution method for a typical transient analysis?

11104 (EPRI-NP—5781-SR, pp 29.1-29.23) **Oyster Creek RETRAN licensing model development.** Alammar, M.A.; Furia, R.V.; Chin, J.H.; Mehta, C.B. (GPU Nuclear Corporation, Parsippany, NJ (USA)). Apr 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88010466/JAW. (CONF-8711152—).

From 5. international RETRAN meeting; Boston, MA, USA (9 Nov 1987).

The development of Oyster Creek RETRAN Licensing model is presented. A three step program was followed namely: Step 1 - Model benchmark against startup tests: the objective here was to assure model stability and to qualify different segments of the model against plant data. A best estimate model was thus established at this stage. Nine startup tests were used. Step 2 - Assurance that the model has built in conservatism with respect to the reload transients it is designed to analyze. Here a sensitivity study was carried out on a number of parameters for the limiting reload transient for Oyster Creek (Turbine Trip Without Bypass). The impact on the Critical Power Ratio was used as the primary measure. Results from this study were used in establishing a conservative set of parameters, uncertainty margin and a proper choice of code options. The implementation of these results established the licensing model. Step 3 - Testing the licensing model response against vendor's analyses for typical reload transients, namely Turbine Trip Without Bypass, Main Steam Isolation Valve Closure Without Scram and Feedwater Controller Failure in Maximum Demand. This methodology has been submitted for NRC approval.

11105 (EPRI-NP—5781-SR, pp 30.1-30.17) **RETRAN modeling of the PWR rod ejection transient.** Erb, J.O.; Miller, J.G. (Virginia Power Company, Richmond (USA)). Apr 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88010466/JAW. (CONF-8711152—).

From 5. international RETRAN meeting; Boston, MA, USA (9 Nov 1987).

The rod ejection transient is a postulated Condition IV event initiated by the mechanical failure of a control rod mechanism pressure housing. Such a failure results in the rapid ejection of a road cluster control assembly from the core followed by a fast reactivity insertion. A sever asymmetric core power distribution may result, possibly leading to fuel rod damage. Reactor protection for the transient is provided by negative reactivity feedback effects and by reactor trips on high neutron flux levels. This transient has been modeled for Virginia's Power's Surry and North Anna Nuclear Power Stations using RETRAN-02. The analysis is performed in two parts. First, the core average power history is calculated using a single-loop model with point kinetics and three axially stacked core control volumes. The ejected rod's reactivity is inserted linearly over 0.1 seconds. The negative reactivity feedback effects due to Doppler and moderator temperature changes, and the reactor trip are also modeled. The effect of the locally peaked core flux shape is approximated by applying a conservative power weighting factor to the Doppler reactivity feedback. The core average power history is adjusted to represent peak core power conditions and input to the hot spot thermal-hydraulics analysis model. The hot spot model predicts maximum fuel enthalpy and temperature transients. This model has two control volumes, one for the hot spot location and the second for a sink for flow from the hot channel. From these results, the amount of fuel damage and the radiological consequences can be assessed.

11106 (EPRI-NP—5781-SR, pp 31.1-31.16) **RETRAN02 analysis of reactor water level controller failure.** Rinckel, J.M. (Cleveland Electric Illuminating Company, Perry, OH (USA)). Apr 1988. Research Reports Center. Box 50490, Palo Alto, CA 94303. Order Number TI88010466/JAW. (CONF-8711152—).

From 5. international RETRAN meeting; Boston, MA, USA (9 Nov 1987).

This study provides a detailed examination of a feedwater flow excursion caused by a Reactor Water Level Controller Failure at the Perry Nuclear Power Plant (3579 Mwth, GE BWR 6). The feedwater flow excursion led to a plant scram due to high reactor water level. Plant conditions were as follows: power 63.5%, coreflow 50.4% and steamflow 60.5%. Both one-dimensional kinetics and point kinetics RETRAN neutronic models for the actual point conditions are implemented. Confidence in the model and modeling techniques was achieved by comparing the analytical transient response with the actual plant data. Measured parameters consisted of recorded data from the Emergency Response Information System, the plant process computer, and other available data acquisition systems. RETRAN observables consist of major and minor edit variables, Trip Summary table, and other printed RETRAN output. Good agreement was found with the parameters monitored: core power, reactor steam dome pressure, core flow, steamflow, and reactor water level.

11107 (EPRI-NP—5781-SR, pp 32.1-32.17) **Analysis of the LOBI-MOD2 natural circulation tests using RETRAN steady state solution scheme.** Rogers, J.M. (United Kingdom Atomic Energy Authority, Dorset (England)). Apr 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88010466/JAW. (CONF-8711152—).

From 5. international RETRAN meeting; Boston, MA, USA (9 Nov 1987).

Natural circulation has long been considered an important aspect of thermal hydraulic behavior, providing a mechanism for removal of heat from the core to the steam generators of a PWR when forced convection has been lost. This is an occurrence in a number of credible accident scenarios. Thus it is important that full plant computer modeling codes predict the behavior adequately, not only by calculating the mass flow correctly for a given set of conditions, but also by indicating the transition between the various modes of natural circulation. To assess the capabilities of RETRAN-02 mod 3 to meet the above objectives, comparison is required against test (or plant) data. This paper describes an analysis of the natural circulation tests on the LOBI-MOD2 Integral Test Facility, sited at JRC-Ispra, jointly funded by the CEC (Commission of the European Communities) and the BMFT (Bundesminister fuer Forschung und Technologie). Parameters of particular interest are the primary inventory, hot leg temperature and void fraction profile around the circuit which are predicted using the three main slip options available. The analysis was carried out by using the steady state initialization module, taking into account the quasi steady state nature of the test chosen. In addition, a brief analysis was performed using a natural circulation theory developed at EPRI, formulated to provide a guide to the characteristics of a system without having to include specific details of the system.

11108 (EPRI-NP—5781-SR, pp 33.1-33.18) **BWR core stability analysis with RETRAN.** Peng, S.J. (MSU System Services, Inc., New Orleans, LA (USA)). Apr 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88010466/JAW. (CONF-8711152—).

From 5. international RETRAN meeting; Boston, MA, USA (9 Nov 1987).

A RETRAN model was developed for determining the stability of boiling water reactor. This model was benchmarked against plant data from stability tests conducted during plant operations. The stability analysis with RETRAN is demonstrated using best estimate RETRAN input data representative of the NSSS. All of the important neutronic and thermal hydraulic feedback mechanisms are taken into account through the modeling of the reactor vessel, recirculation loops and core neutronics. The analysis was performed with the RETRAN02 MOD003 computer code. The transient is initialized by a small step decrease in the steam dome pressure. The core exit (upper plenum) pressure and core power transient responses to this perturbation are transformed into frequency data and a system transfer function is then obtained. The system transfer function is fitted to a second order equation from which the decay ratio and natural frequency can be determined.

11109 (EPRI-NP—5781-SR, pp 34.1-34.28) **BWR stability analysis with RETRAN.** Sorensen, J. (S. Levy Incorporated, Campbell, CA (USA)). Apr 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88010466/JAW. (CONF-8711152—).

From 5. international RETRAN meeting; Boston, MA, USA (9 Nov 1987).

The possibility of instabilities under certain conditions of operation has been a special concern for boiling water reactors (BWR). A stability analysis is performed to demonstrate that the total system and its primary components are inherently stable over the allowable operating envelope. Generally, it must be demonstrated that the reactor core and associated coolant, control, and protection systems are designed to assure that power or flow oscillations which can result in conditions exceeding specified acceptable fuel design limits are not possible or can be reliably and readily detected and suppressed. There are three general types of stability considered in the analysis of the BWR system: A. Stability of the entire reactor system with changes in system pressure, flow and water level as determined by the coupled response of the overall plant and the turbine-reactor control systems (Total Plant Stability). Stability of the reactor core in response to changes in core flow, subcooling or pressure, including nuclear feedback effects from changes in core voids and fuel temperature (Core Reactivity Stability). C. Stability of individual fuel assemblies within the core at various power and flow conditions due to perturbations in flow or channel boundary conditions, independent of reactor system controls or nuclear feedback (Channel Hydrodynamic Stability). The applicability of RETRAN for analysis of all three forms of stability has been demonstrated. Modeling requirements and analysis results are presented.

11110 (EPRI-NP—5781-SR, pp 35.1-35.21) **RETRAN-02 modeling activities for Alto Lazio BWR transient analysis.** Garbossa, G.B.; Bernardo, A.; Di Gasbarro, F.; Augello, L.; Marchiondelli, C. (Ente Nationale per l'Energia Elettrica, Roma (Italy)). Apr 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88010466/JAW. (CONF-8711152—).

From 5. international RETRAN meeting; Boston, MA, USA (9 Nov 1987).

Development of BWR transient simulation capability at the Italian Electricity Board was promoted by the Construction Department in early 1985. The primary purpose of this activity is to develop validated RETRAN-02 models of Alto Lazio station, currently under construction at Montalto di Castro. The basic RETRAN model, developed in accordance with Quality Assurance procedures and based on actual plant data, is described. A detailed nodalization of the nuclear steam generator and the steam lines along with a coarse noding of the Balance Of Plant are adopted. The main reactor control systems are simulated as well. A point reactor kinetics option is so far used, but the 1-D reactor kinetics model is now under testing. Some typical operational transients (Generator load rejection with by-pass, one recirculation pump seizure and Loss of feedwater flow), used to perform model validation by comparison with the results of the Final Safety Analysis Report, are presented. Other analyses are under way to improve the knowledge of reactor behavior during transients and postulated accidents. Some preliminary results, related to the accidental opening of all safety/relief valves, are presented.

11111 (EPRI-NP—5781-SR, pp 36.1-36.19) **RETRAN application for transient simulator validation.** Surjanto, T.B. (Nuclear Safety & Fuel, Birmingham, AL (USA)). Apr 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88010466/JAW. (CONF-8711152—).

From 5. international RETRAN meeting; Boston, MA, USA (9 Nov 1987).

Application of the EPRI methodology to the Plant Vogtle Simulator transient requirements for validation has yielded six transient events to be analyzed. The selected set of transient consists of minimum complementary transients that are anticipated to exercise all the dynamic modes. Based on this set of transients, scenarios of each transient were developed and executed. Similar initial conditions and scenarios were also run with RETRAN under two different conditions. The first was run based solely on boundary conditions, including the power level, obtained from the simulator, and the second was run using the independent RETRAN plant model. The purpose of the first run was to minimize the model differences between the simulator and RETRAN. The second run was intended to verify that all the plant component models are responding sensibly to the transient and to verify the performance of the non-RCS simulator model. These transients are Locked Rotor, Loss of All AC, Loss of Feedwater/ATWS, Steam Generator Tube Rupture/Pressurizer Safety Valve Stuck Open, Main Steam Line Break, and the Three Mile Island Sequence. RETRAN analyses indicate that the dynamic modes in the pressurizer and reactor coolant pump model has been completely exercised. Since the best-estimate plant model was used, the transient results are not as severe as expected; therefore, not all the dynamic modes were completely exercised. Nevertheless, the RETRAN model performed without simulator boundary conditions has demonstrated to be a viable tool in confirming the occurrence of component dynamic modes, which is used as the basis for the transient validation.

11112 (EPRI-NP—5781-SR, pp 37.1-37.24) **Simulator verification effort at the South Texas Project Electric Generating Station.** Bellmore, P.E. (Houston Lighting & Power Company, TX (USA)). Apr 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88010466/JAW. (CONF-8711152—).

From 5. international RETRAN meeting; Boston, MA, USA (9 Nov 1987).

This paper discusses the simulator verification work being performed at Houston Lighting & Power. Topics include best estimate and licensing analysis modeling techniques, model comparisons for a turbine trip transient, and the interaction between the various groups responsible for simulator verification. The paper shows that simulator verification requires a best estimate model. This is shown using the turbine transient comparisons. The paper also identifies the transients modeled for simulator verification.

11113 (EPRI-NP—5781-SR, pp 38.1-38.18) **RETRAN model for the Perry Nuclear Power Plant for implementation in the low power core flow region.** Rogow, R. (Cleveland Electric Illuminating Company, Perry, OH (USA)). Apr 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88010466/JAW. (CONF-8711152—).

From 5. international RETRAN meeting; Boston, MA, USA (9 Nov 1987).

The main objective of the present endeavor has been to construct a basecase best estimate RETRAN model for utilization in the low region of the power-core flow domain above the natural circulation threshold. The thrust of the modeling effort involved quantifying compatible boundary conditions from plant data, as well as characterizing steam separation responses for the upper downcomer and separator-dryer nodes. A judicious choice of the bubble separation velocities and density distributions is relevant for the power-flow range under consideration, since level responses may be vastly impacted by the bubble rise parameters. An algorithm has been implemented to determine bubble velocities and density distributions from mass transfer formalisms. The model generated responses have been benchmarked against startup test data obtained from the Loss of Turbine Generator and Offsite Power test. The responses of the turbine bypass and stop valves have been modeled as a fill table. The algorithm updating bubble rise parameters although appearing generic have been initialized to yield transient dependent results and needs to be validated for ranges beyond the constraints of the present model.

11114 (EPRI-NP—5781-SR, pp 39.1-39.15) **Pressurizer quench tank response for a loss-of-load event at the Calvert Cliffs Plant.** Williams, J.F.; Danner, M.A. (Baltimore Gas & Electric Company, MD (USA)). Apr 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88010466/JAW. (CONF-8711152—).

From 5. international RETRAN meeting; Boston, MA, USA (9 Nov 1987).

In January, 1987, relief valve leakage during RCS leak rate testing caused the rupture disc on the Calvert Cliffs Unit 1 pressurizer quench tank to burst. This event led to analysis of expected tank response for anticipated transients. Changes are recommended for operating practices, and revision of the FSAR and rupture disc specification are suggested.

11115 (EPRI-NP—5781-SR, pp 40.1-40.19) **Development of emergency planning exercise scenarios using the RETRAN and MAAP codes for the Zion federal field exercise.** Griffin, J.L.; Ramsden, K.B.; Mika, R.E. (Commonwealth Edison Company, Chicago, IL (USA)). Apr 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88010466/JAW. (CONF-8711152—).

From 5. international RETRAN meeting; Boston, MA, USA (9 Nov 1987).

This report summarizes the analytical work performed at Commonwealth Edison in support of the Zion GSEP exercise. Calculations were performed using the RETRAN and MAAP codes to validate the major aspects of the exercise, as executed on the Zion simulator, as well as to provide data in the core degradation portion of the drill.

11116 (EPRI-NP—5781-SR, pp 41.1-41.14) **Comparison utilizing COMMIX 1B to validate the downcomer and lower plenum mixing calculated by rETRAN 02 MOD 3 for the steam line break transient.** Taylor, D. (Commonwealth Edison Company, Chicago, IL (USA)). Apr 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88010466/JAW. (CONF-8711152—).

From 5. international RETRAN meeting; Boston, MA, USA (9 Nov 1987).

The steam line break transient has been analyzed for Zion Station utilizing RETRAN 02 mod 3. As expected, downcomer and lower plenum mixing play an important role in the timing and absolute value of the return to power which occurs in this event. To determine the level of conservatism in the downcomer and lower plenum mixing as calculated by the RETRAN model, a downcomer and lower plenum model was developed utilizing COMMIX 1B. This COMMIX model employed parameters from the RETRAN steam line break transient. The resulting mixing calculated by the COMMIX model was then compared to the mixing calculated by the RETRAN downcomer and lower plenum model. From this comparison it was determined that even when utilizing the most conservative options available in COMMIX, the COMMIX model predicts a greater level of mixing than that which is predicted by the RETRAN model. This provides confidence that the RETRAN 02 model for Zion Station is conservatively predicting downcomer and lower plenum mixing during the steam line break transient.

11117 **(EPRI-NP—6000) Human factors affecting the performance of inspection personnel in nuclear power plants: Final report.** Karimi, S.S. (Electric Power Research Inst., Palo Alto, CA (USA)). Dec 1988. 136p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI89004453/JAW.

This study investigates the problem of poor performance among nuclear power plant inspection personnel both in training and in the field. First, a systems perspective is employed to explore the psychological processes and relevant human factors that may be associated with workers' inadequate performance. Second, two separate yet related approaches are used to clarify the definition of competence: (1) a theory-based (or "top-down") approach, in which effective performance is construed as a product of a skillful, motivated person interacting with a responsive environment; and (2) an empirical (or "bottom-up") approach, in which key persons and context characteristics are generated based on the opinions of experts in the industry. Using a series of semi-structured interviews, two empirical studies were conducted in the latter approach. Overall, the results of both studies converged with the theoretical analysis emphasizing (1) the reciprocal and dynamic interplay of contextual and motivational factors influencing performance, and (2) the salient role of supervisory practices in terms of support, cooperation, and efficiency in contributing to the outcome of performance. 53 refs., 14 figs., 7 tabs.

11118 **(EPRI-NP—6103-CCM-Vol.4) The stability analysis using two fluids (SAT) code for boiling flow systems: Volume 4, Experiments and model validation.** Roy, R.P.; Dykhuizen, R.C.; Su, M.G.; Jain, P. (Electric Power Research Inst., Palo Alto, CA (USA); Arizona State Univ., Tempe (USA). Dept. of Mechanical and Aerospace Engineering). Dec 1988. 87p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number DE89004481/JAW.

This report presents analyses of dynamic instability and frequency response characteristics of boiling flow systems based on an unequal velocity, unequal temperature two-fluid model of such flow. The dynamic instability analyses in the time domain are incorporated into three options of a computer code SAT (steady state, or equilibrium point analyses; linear stability analysis; and nonlinear analysis). The frequency response analysis is incorporated into a fourth option FREQ. Results from dynamic instability experiments carried out in a Refrigerant-113 boiling flow rig are also reported as are comparison of these with linear stability analysis predictions. Descriptions of the model, the computational techniques, the computer codes, the experiments and model validation are divided into the following volumes: Volume 1, theoretical model and computational formulation; Volume 2, coding description; Volume 3, user's manual; and Volume 4, experiments and model validation. Instability experiments run in our Refrigerant-113 boiling flow facility are described in this document. Results from these experiments are compared with predictions of the theoretical model. Instability experiment data from two other facilities and frequency response re-

sults from one are compared with theoretical model predictions also. 19 refs., 41 figs.

11119 **(EPRI-NP—6111) Parametric radionuclide release calculations using the MAAP-3.0 computer code: Final report.** Mendoza, Z.T. (Electric Power Research Inst., Palo Alto, CA (USA); Science Applications International Corp., Los Altos, CA (USA)). Nov 1988. 134p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI89004452/JAW.

This report documents an analysis of the radiological source terms for severe accidents in Light Water Reactors (LWR) using the Industry Degraded Core Rulemaking Program (IDCOR) integrated accident analysis methodology. The analytical study is an on-going effort sponsored by EPRI to investigate the sensitivity of the Modular Accident Analysis Program (MAAP) code predictions. This supplements an analysis, reported in an interim report (EPRI NP-4437), that had used an earlier version of the code. Two reference plant containment designs were evaluated: (1) a BWR Mark I containment design, represented by the Peach Bottom Plant, and (2) a PWR large dry containment design, represented by the Zion Nuclear Power Station. These reference LWR plants have been analyzed in the Severe Accidents Risk Reduction/Risk Rebaselining Program (SARRP) conducted by NRC. Source terms were calculated for accident scenarios to be dominant in the SARRP (NUREG-1150) risk assessments: a transient event with failure to scram and station blackout sequences for Peach Bottom; and a pump seal LOCA and transient events for Zion. The predicted results were not very sensitive to code input parameter changes, with the exception of assumptions related to sequence definitions such as active operator actions and containment failure characterization for the BWR plant. For the PWR Zion analysis, early containment failure at vessel breach to simulate the NUREG-1150 STCP calculations could not be achieved because by differences between the MARCH3 (STCP) and MAAP3.0 modeling assumptions relative to hydrogen production and combustion. Under similar sequence definitions, the MAAP3.0 code calculates slightly higher CsI release fractions than STCP due to revaporization, but exhibited a wide range of values in the distribution within the containment system. 17 refs., 48 figs., 41 tabs.

11120 (INIS-mf—11332, pp 27) **Evaluation of the effective dose equivalent to the public of Pavia after the Chernobyl nuclear accident.** Altieri, S.; Rosti, G.; Berzero, A.; Genova, N.; Meloni, S. (Pavia Univ. (Italy)). 1988. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705189/JAW. (CONF-8809213—).

From IAEA Meeting: 10th European TRIGA users' conference; Vienna, Austria (14 Sep 1988).

11121 (INIS-mf—11332, pp 26) **Fission products distribution for Istanbul in an hypothetic reactor accident.** Bayuelken, A.R.; Barla, M.C. (Istanbul Technical Univ. (Turkey). Inst. for Nuclear Energy; Istanbul Technical Univ., Faculty of Aeronautics and Astronautics, Istanbul (Turkey)). 1988. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705189/JAW. (CONF-8809213—).

From IAEA Meeting: 10th European TRIGA users' conference; Vienna, Austria (14 Sep 1988).

11122 (INIS-mf—11332, pp 21) **Probabilistic safety assessment of the research reactor Triga Mark 2.** Dimic, V.; Vojnovic, D.; Dusic, M. (Institut Jozef Stefan, Ljubljana (Yugoslavia)). 1988. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705189/JAW. (CONF-8809213—).

From IAEA Meeting: 10th European TRIGA users' conference; Vienna, Austria (14 Sep 1988).

11123 (INIS-mf—11332, pp 22) **Probabilistic safety assessment for the Vienna Triga reactor.** Boeck, H.; Kirchsteiger, C. (Atominstitut der Oesterreichischen Universitaeten, Vienna). 1988. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705189/JAW. (CONF-8809213—).

From IAEA Meeting: 10th European TRIGA users' conference; Vienna, Austria (14 Sep 1988).

11124 (INIS-mf—11332, pp 23) **Radiation protection at the Vienna Triga reactor.** Tschurlovits, M.; Slanetz, H. (Atominstitut der Oesterreichischen Universitaeten, Vienna). 1988. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705189/JAW. (CONF-8809213—).

From IAEA Meeting: 10th European TRIGA users' conference; Vienna, Austria (14 Sep 1988).

11125 **(Juel—2200) Core dynamics of HTR under ATWS and accident conditions.** Nabbi, R. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Nukleare Sicherheitsforschung). May 1988. 122p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88756375/JAW.

The systematic classification of the ATWS has been undertaken by analogy to the considerations made for LWR. The initiating events of ATWS and protection actions of safety systems resulting from monitoring of the system variables have been described. The main emphasis of this work is the analysis of the core dynamic consequences of scram failure during the anticipated transients. The investigation has shown that because of the temperature feedback mechanisms a temperature rise during the ATWS results in a self-shutdown of the reactor. Further inherent safety features of the HTR - conditioned by the high heat capacity of the core and by the compressibility of the coolant - do effectively counteract an undesirable increase of temperature and pressure in the primary circuit. In case of the long-term failure of the forced cooling and following core heatup, neutron physical phenomena appear which determine the reactivity behaviour of the HTR. They are, for instance, the decay of Xenon 135, release of the fission products and subsiding of the top reflector. The results of the computer simulations show that a recriticality has to be excluded during the first 2 days if the reactor is shutdown by the reflector rods at the beginning of the accident.

11126 **(KFK—4330) Program system UFOMOD for assessing the consequences of nuclear accidents.** Ehrhardt, J.; Burkart, K.; Hasemann, I.; Matzerath, C.; Panitz, H.J.; Steinhauer, C. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Neutronenphysik und Reaktortechnik; Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Projektgruppe LWR-Sicherheit). Oct 1988. 139p. NTIS (US Sales Only), PC A07/MF A01. Order Number DE88756384/JAW.

The programm system UFOMOD is a completely new accident consequence assessment (ACA) code. Its structure and modelling is based on the experience gained from applications of the old UFOMOD code during and after the German Risk Study - Phase A, the results of scientific investigations performed within the ongoing Phase B and the CEC-project MARIA, and the requirements resulting from the extended use of ACAs to help in decision-making. One of the most important improvements is the introduction of different trajecotry models for describing atmospheric dispersion in the near range and at larger distances. Emergency actions and countermeasures modelling takes into account recommendations of international commissions. The dosimetric models contain completely new age-, sex- and time-dependent data of dose-conversion factors for external and internal radiation; the ingestion pathway is modelled to consider seasonal dependencies. New dose-risk-relationships for stochastic and non-stochastic health effects are implemented; a special algorithm developed for ACA codes allows individual and collective leukemia and cancer risks to be presented as a function of time after the accident. According to the modular structure of the new program system UFOMOD, an easy access to parameter values and the results of the various submodels exists what facilitates sensitivity and uncertainty analyses.

11127 **(KFK—4422) Chemical interactions of Zircaloy-4 tubing with UO/sub 2/ fuel and oxygen at temperatures between 900 and 2000/sup 0/C (experiments and PECLOX code). Pt. 1-3. Pt. 1: Experimental results. Pt. 2: PECLOX: A computer model for the calculation of the internal and the external Zircaloy cladding oxidation. Pt. 3: Verification of the PECLOX code.** Hofmann, P.; Neitzel, H.J.; Garcia, E.A. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Material- und Festkoerperforschung; Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorbauelemente; Comision Nacional de Energia Atomica, Buenos Aires (Argentina). Dept. de Materiales). Oct 1988. 123p. (CNEA-NT—36/87). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88756388/JAW.

Under severe fuel damage (SFD) conditions a combined external and internal oxidation of the fuel rod cladding (Zircaloy-4) occurs due to a reaction with steam or oxygen on the outside surface and the UO/sub 2/ fuel on the inside surface. These reactions result in the formation of oxygen-stabilized α-Zr(O) phases, ZrO/sub 2/ and a (U,Zr) alloy. The reaction kinetics have been studied with both isothermal and transient temperature experiments above 900/sup 0/C. The tests were performed using short LWR fuel rod sections in an (Ar+25 vol.% O/sub 2/) environment. The growth of the interaction layers initially obey parabolic rate laws. The numerical code PECLOX has been developed which solves the Fick and Stefan equations. It predicts the formation, growth, and disappearance of the various interaction layers and the corresponding oxygen profiles as functions of temperature and time. The diffusion of oxygen into the Zircaloy cladding is assumed to be the rate-determining step for the growth of the interaction layers. The experimental results of isothermal and temperature transient UO/sub 2// Zircaloy interaction experiments under oxidizing conditions were used to test the PECLOX code. The comparison between PECLOX calculations and experimental results show a good agreement.

11128 **(N—89-10944) Nuclear propulsion: a vital technology for the exploration of Mars and the planets beyond.** Borowski, S.K. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). 1988. 47p. (NASA-TM—101354; E—4369; NAS—1.15:101354; CONF-8707205—). NTIS, PC A03/MF A01.

From Case for Mars 3 conference; Boulder, CO, USA (18 Jul 1987).

The physics and technology issues and performance potential of various direct thrust fission and fusion propulsion concepts are examined. Next to chemical propulsion the solid core fission thermal rocket (SCR) is the olny other concept to be experimentally tested at the power (approx 1.5 to 5.0 GW) and thrust levels (approx 0.33 to 1.11 MN) required for manned Mars missions. With a specific impulse of approx 850 s, the SCR can perform various near-Earth, cislunar and interplanetary missions with lower mass and cost requirements than its chemical counterpart. The gas core fission thermal rocket, with a specific power and impulse of approx 50 kW/kg and 5000 s offers the potential for quick courier trips to Mars (of about 80 days) or longer duration exploration cargo missions (lasting about 280 days) with starting masses of about 1000 m tons. Convenient transportation to the outer Solar System will require the development of magnetic and inertial fusion rockets (IFRs). Possessing specific powers and impulses of approx 100 kW/kg and 200-300 kilosecs, IFRs will usher in the era of the true Solar System class speceship. Even Pluto will be accessible with round-trip times of less than 2 years and starting masses of about 1500 m tons.

11129 **(NUREG—0797-Suppl.17) Safety evaluation report related to the operation of Comanche Peak Steam Electric Station, Units 1 and 2 (Docket Nos. 50-445 and 50-446).** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Special Projects). Nov 1988. 395p. NTIS, PC A17/MF A01 - GPO - OSTI. Order Number TI89004217/JAW.

Supplement 17 to the Safety Evaluation Report related to the operation of the Comanche Peak Steam Electric Station (CPSES), Units 1 and 2 (NUREG-0797), has been prepared by the Office of Special Projects of the US Nuclear Regulatory Commission (NRC). The facility is located in Somervell County, Texas, approximately 40 miles southwest of Fort Worth, Texas. This supplement presents the staff's evaluation of the applicant's Corrective Action Program (CAP) related to the mechanical, civil/structural, electrical, instrumentation and control (I&C), and heating, ventilation, and air conditioning (HVAC) disciplines. This supplement only addresses the systems portion of HVAC. Other aspects of HVAC (e.g., duct and supports) are covered in another supplement. The scope and methodologies for these CAP workscopes, as summarized in project status reports and as detailed in related documents referenced in this evaluation, were developed to resolve various design issues raised by the Comanche Peak Response Team (CPRT), CYGNA Energy Services (CYGNA), and the NRC staff. The NRC staff concludes that the CAP workscopes for mechanical, civil/structural, electrical, I&C, and HVAC systems provide a comprehensive program for resolving the associated technical concerns identified by the CPRT, CYGNA, and the NRC staff and their implementation ensures that the design of related systems, structures, and components at CPSES satisfies the applicable requirements of 10 CFR Part 50.

11130 **(NUREG—0797-Suppl.18) Safety evaluation report related to the operation of Comanche Peak Steam Electric Station, Units 1 and 2 (Docket Nos. 50-445 and 50-446).** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Special Projects). Nov 1988. 100p. NTIS, PC A05/MF A01 - GPO - OSTI. Order Number TI89004215/JAW.

Supplement 18 to the Safety Evaluation Report related to the operation of the Comanche Peak Steam Electric Station (CPSES), Units 1 and 2 (NUREG-0797), has been prepared by the Office of Special Projects of the US Nuclear Regulatory Commission (NRC). The facility is located in Somervell County, Texas, approximately 40 miles southwest of Fort Worth, Texas. This supplement presents the staff's evaluation of the applicant's Corrective Action Program (CAP) related to the structural design of the heating, ventilation, and air conditioning (HVAC) systems. The scope and methodologies for the CAP workscope as summarized in Revision 0 to the HVAC project status report and as detailed in related documents referenced in this evaluation were developed to resolve the technical concerns identified in the HVAC area. The NRC staff concludes that the CAP workscope for the HVAC structural design provides a comprehensive program for resolving the associated technical concerns and its implementation ensures that the structural design of the HVAC systems at CPSES satisfies the applicable requirements of 10 CFR Part 50. 32 refs.

11131 **(NUREG—0797-Suppl.19) Safety evaluation report related to the operation of Comanche Peak Steam Electric Station, Units 1 and 2 (Docket Nos. 50-445 and 50-446).** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Special Projects). Nov 1988. 65p. NTIS, PC A04/MF A01 - GPO - OSTI. Order Number TI89004343/JAW.

Supplement 19 to the Safety Evaluation Report related to the operation of the Comanche Peak Steam Electric Station (CPSES), Units 1 and 2 (NUREG-0797), has been prepared by the Office of Special Projects of the US Nuclear Regulatory Commission (NRC). The facility is located in Somervell County, Texas, approximately 40 miles southwest of Fort Worth, Texas. This supplement presents the staff's evaluation of the Texas Utilities Electric Company's (lead applicant's) corrective action program (CAP) related to equipment qualification. The scope and methodology for the CAP workscope, as summarized in Revision 0 to the Equipment Qualification Project Status Report and as detailed in related documents, were developed to resolve various issues raised by the Comanche Peak Response Team (CPRT) and the NRC staff to ensure that plant equipment is appropriately environmentally and/or seismically and dynamically qualified and documented in accordance with the validated plant design resulting from other CAP scopes of work for Unit 1 and areas common to Units 1 and 2. The staff concludes that the CAP workscope for equipment qualification provides a comprehensive program for resolving the concerns identified by the CPRT and the NRC staff, including issues raised in the Comanche Peak Safety Evaluation Report and its supplements, and its implementation will ensure that the environmental and/or

seismic and dynamic qualification of equipment at CPSES satisfies the validated plant design and the applicable requirements of 10 CFR Part 50. As is routine staff practice, the NRC staff will verify the adequacy of implementation of the environmental and seismic and dynamic equipment qualification program at CPSES during inspections that will take place before fuel loading. 97 refs.

11132 **(NUREG—0797-Suppl.20) Safety evaluation report related to the operation of Comanche Peak Steam Electric Station, Units 1 and 2: Docket No. 50-445 and 50-446.** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Special Projects). Nov 1988. 223p. NTIS, PC A10/MF A01 - GPO - OSTI. Order Number TI89004216/JAW.

Supplement 20 to the Safety Evaluation Report related to the operation of the Comanche Peak Steam Electric Station (CPSES), Units 1 and 2 (NUREG-0797), has been prepared by the Office of Special Projects of the US Nuclear Regulatory Commission (NRC). The facility is located in Somervell County, Texas, approximately 40 miles southwest of Fort Worth, Texas. This supplement presents the staff's evaluation of CPRT implementation of the Comanche Peak Response Team (CPRT) Program Plan and the issue-specific action plans (ISAPs), as well as the CPRT's investigations to determine the adequacy of various types of programs and hardware at CPSES. The results and conclusions of the CPRT activities are documented in a results report for each ISAP, a Collective Evaluation Report (CER), and a Collective Significance Report (CSR). This supplement also presents the staff's safety evaluation of TU Electric's root cause assessment of past CPSES design deficiencies and weaknesses. The NRC staff concludes that the CPRT has adequately implemented its investigative activities related to the design, construction, construction quality assurance/quality control, and testing at CPSES. The NRC staff further concludes that the CPRT evaluation of the results of its investigation is thorough and complete and its recommendations for corrective actions are sufficient to resolve identified deficiencies.

11133 **(NUREG—1275-Vol.3) Operating experience feedback report: Service water system failures and degradations: Volume 3.** Lam, P.; Leeds, E. (Nuclear Regulatory Commission, Washington, DC (USA). Office for Analysis and Evaluation of Operational Data). Nov 1988. 157p. NTIS, PC A08/MF A01 - GPO - OSTI. Order Number TI89004587/JAW.

A comprehensive review and evaluation of service water system failures and degradations observed in operating events in light water reactors from 1980 to 1987 has been conducted. The review and evaluation focused on the identification of causes of system failures and degradations, the adequacy of corrective actions implemented and planned, and the safety significance of the operating events. The results of this review and evaluation indicate that the service water system failures and degradations have significant safety implications. These system failures and degradations are attributable to a great variety of causes, and have adverse impact on a large number of safety-related systems and components which are required to mitigate reactor accidents. Specifically, the causes of failures and degradations include various fouling mechanisms (sediment deposition, biofouling, corrosion and erosion, pipe coating failure, calcium carbonate, foreign material and debris intrusion); single failures and other design deficiencies; flooding; multiple equipment failures; personnel and procedural errors; and seismic deficiencies. Systems and components adversely impacted by a service water system failure or degradation include the component cooling water system, emergency diesel generators, emergency core cooling system pumps and heat exchangers, the residual heat removal system, containment spray and fan coolers, control room chillers, and reactor building cooling units. 44 refs., 10 figs., 5 tabs.

11134 **(NUREG/CR—4527-Vol.2) An experimental investigation of internally ignited fires in nuclear power plant control cabinets: Part 2, Room effects tests.** Chavez, J.M.; Nowlen, S.P. (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Engineering; Sandia National Labs., Albuquerque, NM (USA)). Nov 1988. Contract AC04-76DP00789. 50p. (SAND—86-0336-Vol.2). NTIS, PC A04/MF A01 - GPO - OSTI. Order Number TI89004072/JAW.

This report presents the findings of the second part of a two-part series of full-scale electrical cabinet fire tests conducted by Sandia National Laboratories for the US Nuclear Regulatory Commission. The first part of this test series investigated the effects of various cabinet parameters on a cabinet fire. The second part of the test series, described here, investigated the effects of such a fire on a large (18.3{times}12.2{times}6.1-m or 60{times} 40{times}20-ft) enclosure. Five tests involving fire in a control cabinet were conducted under Part 2 of the test series. These tests investigated the effects of fuel type, cabinet configuration, and enclosure ventilation rate on the development of the enclosure environment. Although fires as large as 1300 kW resulted, enclosure peak temperatures (outside the fire plume itself) were typically less than 150{degree}C, with significant vertical thermal stratification observed. The most significant impact on the test enclosure environment was that dense smoke, in all cases, resulted in total obscuration of the enclosure within 6-15 min of fire ignition. Enclosure ventilation rates as high as 8 room air changes per hour were found to be ineffective in purging the smoke from this large enclosure. Similar obscuration problems had also been observed in the Part 1 tests, which utilized a smaller enclosure with ventilation rates as high as 15 room air changes per hour. 7 refs., 39 figs., 1 tab.

11135 **(NUREG/CR—4916) HECTR [Hydrogen Event: Containment Transient Response] analyses of the Nevada Test Site (NTS) premixed combustion experiments.** Wong, C.C. (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Systems Research; Sandia National Labs., Albuquerque, NM (USA)). Nov 1988. Contract AC04-76DP00789. 177p. (SAND—87-0956). NTIS, PC A09/MF A01 - GPO - OSTI. Order Number TI89004694/JAW.

The HECTR (Hydrogen Event: Containment Transient Response) computer code has been developed at Sandia National Laboratories to predict the transient pressure and temperature responses within reactor containments for hypothetical accidents involving the transport and combustion of hydrogen. Although HECTR was designed primarily to investigate these phenomena in LWRs, it may also be used to analyze hydrogen transport and combustion experiments as well. It is in this manner that HECTR is assessed and empirical correlations, such as the combustion completeness and flame speed correlations for the hydrogen combustion model, if necessary, are upgraded. In this report, we present HECTR analyses of the large-scale premixed hydrogen combustion experiments at the Nevada Test Site (NTS) and comparison with the test results. The existing correlations in HECTR version 1.0, under certain conditions, have difficulty in predicting accurately the combustion completeness and burn time for the NTS experiments. By combining the combustion data obtained from the NTS experiments with other experimental data (FITS, VGES, ACUREX, and Whiteshell), a set of new and better combustion correlations was generated. HECTR prediction of the containment responses, using a single-compartment model and EPRI-provided combustion completeness and burn time, compares reasonably well against the test results. However, HECTR prediction of the containment responses using a multicompartment model does not compare well with the test results. This discrepancy shows the deficiency of the homogeneous burning model used in HECTR. To overcome this deficiency, a flame propagation model is highly recommended. 16 refs., 84 figs., 5 tabs.

11136 **(SAND—88-1969C) The effects of aging on the fire vulnerability of nuclear power plant components.** Nowlen, S.P. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 11p. (CONF-8810244—1). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89003236/JAW.

From 16. light water reactor safety conference; Washington, DC, USA (24 Oct 1988).

Sandia National Laboratories, under the sponsorship of the US Nuclear Regulatory Commission, has initiated an effort to identify and investigate potential nuclear power plant fire safety issues associated with plant aging. The issues of potential concern, which have been identified are the effects of aging on (1) the vulnerability of electrical equipment to fire induced damage; (2) the propensity with which electrical equipment will initiate, or contribute to the severity of, fires; and (3) the integrity of passive fire protection fea-

tures. Efforts in this program were initiated late in fiscal year 1988. For fiscal year 1989 efforts will focus on the investigation of the effects of aging on cable damageability and cable flammability. This paper presents the findings of a limited review of past electrical equipment fire aging research and a summary of planned activities for fiscal year 1989. 11 refs., 4 figs.

11137 **(SAND—88-2329C) Assessment of models for steam release from concrete and implications for modeling corium behavior in reactor cavities.** Washington, K.E.; Carroll, D.E. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 22p. (CONF-8810155—27). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004376/JAW.

From 16. water reactor safety information meeting; Gaithersburg, MD, USA (24 Oct 1988).

Models for concrete outgassing have been developed and incorporated into a developmental version of the CONTAIN code for the assessment of corium behavior in reactor cavities. The resultant code, referred to as CONTAIN/OR in order to distinguish it from the released version of CONTAIN, has the capability to model transient heat conduction and concrete outgassing in core-concrete interaction problems. This study focused on validation and assessment of the outgassing model through comparisons with other concrete response codes. In general, the model is not mechanistic; however, there are certain important processes and feedback effects that are treated rigorously. The CONTAIN outgassing model was compared against two mechanistic concrete response codes (USINT and SLAM). Gas release and temperature profile predictions for several concrete thicknesses and heating rates were performed with acceptable agreement seen in each case. The model was also applied to predict corium behavior in a reactor cavity for a hypothetical severe accident scenario. In this calculation, gases evolving from the concrete during nonablating periods fueled exothermic Zr chemical reactions in the corium. Higher corium temperatures and more concrete ablation were observed when compared with that seen when concrete outgassing was neglected. Even though this result depends somewhat upon the makeup of the corium sources and the concrete type in the cavity, it does show that concrete outgassing can be important in the modeling of corium behavior in reactor cavities. In particular, the need to expand the traditional role of CORCON from steady-state ablation to the consideration of more transient events is clearly evident as a result of this work. 5 refs., 11 figs., 1 tab

11138 **(SAND—88-2398C) Overview of the CONTAIN LMR code.** Carroll, D.E. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 13p. (CONF-8810229—2). NTIS, PC A03 - OSTI. Order Number DE89004038/JAW.

From Workshop on nondestructive measurement technology to assess material property and property changes related to aging; Gaithersburg, MD, USA (27 Oct 1988).

The use of containments in proposed US Liquid Metal Reactors (LMR) will require that a computational tool be available for safety analysis. As a result of an international cooperative effort, such a tool has been produced in the CONTAIN-LMR computer code. This is a version of the CONTAIN code that has been enhanced with extra capabilities for LMR applications. CONTAIN is the NRC's best-estimate code for the evaluation of the conditions that may exist inside a reactor containment building during a severe accident. Included in the phenomena modeled are thermal-hydraulics, radiant and convective heat transfer, aerosol loading and transient response, fission product transport and heating effects, and interactions of sodium and corium with the containment atmosphere and structures. CONTAIN-LMR includes models for sodium-concrete interactions, debris bed phenomena and other LMR-specific models in an integrated manner. This paper summarizes the current state of CONTAIN-LMR. A brief description of the physical models is presented. As an example of model integration in CONTAIN-LMR, recent work on the debris bed models will be discussed. Recent applications of CONTAIN-LMR are discussed. 9 refs., 5 figs.

11139 **(SCPRI-RM—6-1988) Monthly results of measurements, June 1988, with supplement related to 1988 second quarter.** (Service Central de Protection contre les Rayonnements Ionisants, 78 - Le Vesinet (France)). Jul 1988. 61p. (In French). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88756266/JAW

This report of the SCPRI exposes an interpretation of the principal results concerning the routine monitoring of environmental radioactivity in France: atmospheric dusts, rainwater, surface water, underground water, sewage water, drinking water, food chain (milk, vegetables, fishes), sea water around nuclear plant sites and other sites. The activities of various radioisotopes are presented in tables. This report exposes also the results of special radiation measurements resulting from the Chernobyl accident.

11140 **(WHC-SA—0419) Advantages of applying cool pump technology to a proposed alternate emergency core cooling system for the N Reactor.** Beaver, T.R. (Westinghouse Hanford Co., Richland, WA (USA)). Oct 1988. Contract AC06-87RL10930. 9p. (CONF-8810236—1). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89003164/JAW.

From Electrical Power Research Institute workshop on cool pump technology; Seattle, WA, USA (26 Oct 1988).

In 1986 a study was conducted to evaluate concepts for an alternate ECCS for N Reactor. The result of this study was a conceptual design that provided operational redundancy and functional diversity to the present ECCS. This alternate ECCS concept uses conventional pumps to provide flow recirculation through the core and optionally through the Graphite and Shield Cooling System (GSCS), with cooling provided by heat exchangers situated over the Emergency Dump Basin (EDB). This paper contains the results of a study where cool pump technology was substituted for conventional centrifugal pumps. A discussion of the application of Cool Pump technology to this alternate ECCS design requires some knowledge of the N Reactor ECCS and its operating requirements. Therefore, this report briefly describes the current ECCS configuration, the alternate ECCS concept, and then describes the several advantages of applying Cool Pump technology to this alternate design. 3 figs.

25 ENERGY STORAGE

2506 Thermal

11141 **(CTH-JVG—26) Economy of heat stores in rock at seasonal storage.** Rosenblad, G. (Chalmers Inst. of Tech., Goeteborg (Sweden). Earth Heat Pump Group). Nov 1987. 31p. (In Swedish). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755762/JAW.

In order to avoid guesswork concerning interest rates, fuel costs etc., calculation have been made to estimate the income that can be generated from a rock-based heat store, and comparisons are made with the investment cost for the plant. The cost of the input energy is treated as a free variable. Three types of storage are considered: caverns, boreholes, and rock beds. The results show that in the best of cases, the income generated can perhaps reach 10-15 percent of the investment cost for the store. Typically, the figures are much lower. Thus, there seems to be low economic potential for seasonal thermal storage in rock in the Swedish energy system. (L.E.).

11142 **(DTH-LV—88-11) Preliminary investigation of the possibilities of utilizing an existing experimental heat storage.** Ussing, V. (Danmarks Tekniske Hoejskole, Lyngby. Lab. for Varmeisolering). Jun 1988. 35p. (In Danish). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755764/JAW.

The purpose of this investigation was to assess the uses and marketing plausibelity of borehole heat storage system, and the associated cost-price benefits. After a description of the construction and operation of an existing steam driven storage system at the Technical University, Denmark, follows an explanation of how a borehole system can be constructed and driven, and it is suggested

that the existing system can be converted for the use of terrestial heat, where horizontal spiral tubing would be utilized. It is concluded that the advent of new and adequate boring equipment and recent developments in relation to heat pump systems with horizontal underground tubing, makes it feasible that borehold tubing should be further improved. This would involve the establishment and surveillance of a demonstration borehole system which could be constructed at the Technical Unviersity so that the two systems could be compared. (AB).

11143 **(PNL—6705) Seasonal Thermal Energy Storage Program: Progress summary for the period April 1986 through March 1988.** Kannberg, L.D. (Pacific Northwest Lab., Richland, WA (USA)). Oct 1988. Contract AC06-76RL01830. 66p. NTIS, PC A04/MF A01 - OSTI. Order Number DE89004978/JAW.

This report discusses recent progress in the DOE program, directed by Pacific Northwest Laboratory, to develop seasonal thermal energy storage (STES). STES has been identified as one method to substantially improve energy efficiency and economics in certain sectors of our economy. It provides a potentially economic means of using waste heat and climatic energy resources to meet a significant portion of our growing energy need for building and industrial process heating and cooling. Environmental benefits accompany the use of STES in many applications. Furthermore, STES can contribute to reduced reliance on premium fuels that are often obtained from foreign sources. Lastly by improving the energy economics of industry, STES can contribute to improved US industrial competitiveness. The report is provided in four sections; the first being this introduction Section 2 of the report describes the program and briefly documents its organization, goals, history, and long-term plans. Section 3 describes the progress during the period from April, 1986, through March, 1988. Section 4 provides a short update on international development of STES. 17 refs., 16 figs., 7 tabs.

2509 Batteries

REFER ALSO TO CITATION(S) 10912

11144 **(CEA-CONF—9646) Electrogravimetrical study of polypyrrole.** Slama, M.; Tanguy, J. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. d'Electronique et d'Instrumentation Nucleaire). Jun 1988. 9p. (CONF-880669—26). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88756327/JAW.

From International conference on science and technology of synthetic metals; Santa Fe, NM, USA (26 Jun 1988).

The weight change of a Polypyrrole cathode during the charge-discharge process in different electrolytes was monitored by the balance technique. The electrochemical behaviour of the electrode depends on the anion size and on the solvent properties. For example, with a relatively small anion ClO/sub 4//sup -/ in PC/LiClO/sub 4/ electrolyte, the cathode weight varies quite linearly versus the electrical charge. We pointed out that ClO/sub 4//sup -/ anions were solvated by 3 PC molecules. For bigger anions such as AsF/sub 6//sup -/ in PC/LiAsF/sub 6/, the weight curve flattens down in the cathodic region. This result can be interpreted by a competition between cation insertion and anion deinsertion. In DMSU/LiClO/sub 4/ we observed a total inversion of the sense of the weight variation. This surprising behaviour suggests that lithium insertion may take place in POPY/DMSU during the reduction process.

11145 **(CEA-CONF—9647) Influence of the electrolyte on the electrochemical doping process of polypyrrole.** Slama, M.; Tanguy, J. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. d'Electronique et d'Instrumentation Nucleaire). Jun 1988. 9p. (CONF-880669—27). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88756328/JAW.

From International conference on science and technology of synthetic metals; Santa Fe, NM, USA (26 Jun 1988).

The redox process in conducting polymers is attributed to an electronic transfer connected to ionic insertion during the oxidation and ionic deinsertion during the reduction. The ionic species involved in this mechanism are solvated by three or four solvent molecules so it appears that the electrochemical doping depends on the nature of the electrolyte used. For example, the total charge stored in polypyrrole or in polyaniline was found 30% higher when using ethylene carbonate instead of propylene carbonate. A lot of polypyrrole working in ethylene carbonate, LiClO/sub /4 electrolyte or in gammabutyrolactone, LiClO/sub /4 have given capacities higher than 90 Ah/kg. With dimethylsulfite, LiClO/sub /4 we observed an electrochemical behavior totally different. Polypyrrole working in DMSU, LiClO/sub /4 exhibits two distinct oxidation peaks which correspond to only one well defined reduction peak. The charge is increased by about a factor two giving capacities higher than 200 Ah/kg. This effect could be explained in assuming lithium insertion during the reduction process.

11146 **(DOE/ER/13219—2) Cogeneration of electric energy and useful chemicals in a high temperature fuel cell: Final report.** Stoukides, M. (Tufts Univ., Medford, MA (USA). Dept. of Chemical Engineering). 1986. Contract FG02-84ER13219. 31p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89003843/JAW.

The overpotential and product selectivity characteristics of the high temperature solid electrolyte fuel cell NH_3, CH_4, HCN, CO, N_2, Pt (Rh){vert←bar}ZrO_2 (8% Y_2O_3){vert←bar}Pt, air was studied at temperatures 800--1000{degree}C and atmospheric total pressure. It was found that CO was the only oxygen containing product. The cell selectivity to HCN could exceed 75% with simultaneous generation of .01 w/cm of electrical power. Electrochemical supply of oxygen to the fuel side has a positive effect on the cell selectivity to HCN. The cell is a promising candidate for the cogeneration of electric energy and hydrogen cyanide. 26 refs., 12 figs.

11147 **(DOE/ID—10146) A simplified version of the Federal Urban Driving Schedule for electric vehicle battery testing.** (EG and G Idaho, Inc., Idaho Falls (USA)). Aug 1988. Contract AC07-76ID01570. 40p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004839/JAW.

A simple version of the Federal Urban Driving Schedule (FUDS) has long been sought after by those involved in electric vehicle battery testing to (1) reduce the cost of hardware required to test electric vehicle batteries and record the data, (2) extract information that cannot be obtained from a continuously transient cycle and (3) decrease the uncertainty in range determination by shortening the cycle. The methodology and results of this effort by the EHP Battery Test Working Task Force for a simplified FUDS battery discharge test cycle (called the SFUDS79) is presented. This battery test cycle may be used to replace the constant-rate discharge tests which are presently used to characterize batteries for electric vehicles, and offers an alternative to the FUDS test while providing the same information regarding battery range and cycle life. 11 figs., 4 tabs.

11148 **(IREQ—7907) The rechargeability of lithium in a non-aqueous medium.** Gauthier, M.; Belanger, A.; Bellemare, R. (Institut de Recherche d'Hydro-Quebec, Varennes (Canada)). 1979. 38p. (In French). (CE—02215). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

Organic polymer-lithium complexes for use in lithium batteries have the advantage of being able to be made in thin films of large surface area, allowing the design of cells with a thickness not exceeding 0.05 in. In this report, certain characteristics of these electrolytic polymers are examined, with emphasis on the following points: techniques of preparation of these polymer complexes and the fabrication of thin films; conductivity of those films as a function of the solute, the thickness and the temperature; cycling of lithium electrodes and stability of the polymer in presence of lithium; and preliminary trials on the in-situ formation of LiAl alloys. The polymer used was ethylene poly-oxide with molecular weights of 600,000 and 5,000,000; the lithium compounds used were lithium trifluoromethane sulfonate, anhydrous LiI, and hydrated LiClO/sub 4/. The conductivity of various thin films of the various lithium complexes studied was measured by means of dc polarization and

other methods. The results, although exploratory, show that although the lithium-polymer complex thin films have relatively low conductivity (0.00005 mho/cm), their ability to be formed in very thin films largely compensates for this. The chemical stability of these complexes in the presence of metallic Li or LiAl is still poorly known, in spite of certain results showing that over short periods of time, freshly-deposited Li can be recuperated with good efficiency during the cycling of the lithium electrode. These results indicate further research in these materials would be worthwhile. 10 refs., 9 figs.

11149 **(LBL—26061) Sodium/beta{double←prime}-alumina/organosulfur batteries operating at intermediate temperatures.** Visco, S.J.; De Jonghe, L.C. (Lawrence Berkeley Lab., CA (USA)). Oct 1988. Contract AC03-76SF00098. 15p. (CONF-881155—27). NTIS, PC A03/MF A01 - OSTI. Order Number DE89004792/JAW.

From Fall meeting of the Materials Research Society; Boston, MA, USA (28 Nov 1988).

Concurrent with impressive advances in advanced batteries operating at high temperatures such as the Na/Na_2S/sub x/ and Li/FeS systems, have been concerns over safety and reliability of such batteries. Accordingly, various efforts have been made to offer alternative high specific energy/power batteries operating at reduced temperatures. However, since electrode kinetics and mass transport processes in batteries are thermally activated, lower temperature systems often present a compromise between lower power output, and enhanced reliability, safety, and economic factors. Fortunately, lower temperature systems also offer far more flexibility in cell design, allowing geometries with higher electrode surface area than would be feasible with high temperature systems, thereby reducing the necessary current densities for acceptable power output. The sodium/organosulfur cells discussed in the following paper are based on the well known Na/beta{double←prime}-alumina/Na_2S/sub x/ battery technology. However, in the present cells the sodium polysulfide electrode which has an operating temperature of 300 to 350{degree}C has been replaced with an organosulfur electrode which is limited at the low temperature limit by the melting point of sodium (~100{degree}C). 10 refs., 5 figs.

11150 **(PB—89-115760/XAB) Battery industry testing and evaluation in India: brochure released on the occasion of the national get-together (1st). Held at Madras, India on 29 July 1987.** (Central Electrochemical Research Inst., Karaikudi (India)). Jul 1987. 85p. NTIS, PC E04/MF A01.

While there is considerable work initiated in CECRI on a variety of battery systems, the Indian battery industry would essentially be confined to three or four systems, such as lead-acid, nickel-cadmium, silver-zinc, and possibly, magnesium-manganese dioxide systems in addition to the leclanche-type dry cells. Batteries are used not only in automobiles for SLI purposes but also as motive power for propelling automobiles. There is considerable discussion on introduction of electric vehicles in the country. In the brochure, scientists of CECRI present the features of various battery systems and their applications.

11151 **(PNL—6746) Inert electrodes program: Annual report, Fiscal year 1987.** Koski, O.H.; Marschman, S.C.; Schilling, C.H.; Windisch, C.F. (Pacific Northwest Lab., Richland, WA (USA)). Dec 1988. Contract AC06-76RL01830. 120p. NTIS, PC A06/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005696/JAW.

The Inert Electrodes Program is being conducted at the Pacific Northwest Laboratory (PNL) for the US Department of Energy (DOE), Office of Industrial Programs (OIP). The purpose of the program is to develop long-lasting, energy-efficient anodes, cathodes, and ancillary equipment for Hall-Heroult cells used by aluminum industry. The program is divided into three tasks with the following objectives: Inert Anode Development - to improve the energy efficiency of Hall-Heroult cells by development of inert anodes; Stable Cathode Studies - to develop methods for retrofitting Hall-Heroult cells with TiB_2-based cathode materials; and Sensor Development - to devise sensors to control the chemistry of Hall-Heroult Cells using stable anodes and cathodes. This Inert Electrodes Program annual report highlights the major technical accomplishment of FY 1987. The accomplishments are presented in the following sections: Management, Materials Development and Testing, Materials Evaluation, Stable Cathode Studies, and Sensor Development. 50 refs., 47 figs.

11152 **(SAND—86-2768) Analysis of $KMnO_4$/NaOH battery header cleaning procedure.** Douglas, S.C.; Bunker, B.C.; Proctor-Puissant, P.M.; Hallett, S.G.; Yelton, W.G. (Sandia National Labs., Albuquerque, NM (USA)). Dec 1988. Contract AC04-76DP00789. 18p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005493/JAW.

$KMnO_4$/NaOH solutions are used to remove the oxides that form on the stainless steel conductor of battery headers during high-temperature glass sealing operations. The cleaning procedure has been evaluated to determine if these corrosive solutions damage TA-23 glass insulators to a degree that would make the headers unacceptable. Battery headers and solid pieces of TA-23 glass were tested, and a colorimetric method was developed to analyze reaction products in the solutions. The analyses showed that the solutions contained 1--10 μg SiO_2per mL, indicating minimal deterioration of the glass. The procedure is an acceptable method for cleaning battery headers containing TA-23 glass insulators. 11 refs., 4 figs., 2 tabs.

11153 **(STU—87-1852) Optimization of the lead-acid battery for electric vehicles.** Simonsson, D. (Kungl. Tekn. Hoegskolan, Stockholm (SE). Inst. f. Kemisk Teknologi). (Swedish National Board for Technical Development, Stockholm). 23 Nov 1987. 41p. (In Swedish). (STU—83-3262). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755904/JAW.

Four problems were studied: Optimum charging and lead batteries; Influence of the gas production on the charging; Optimization of the battery for electric vehicles; The discharging capacity of the porous lead electrode. Both theoretical and experimental studies were performed in these areas in order to elucidate the suitability of lead-acid batteries for propulsion of electric vehicles. (L.E.).

11154 **Battery-powered current supply for superconductor measurements.** Bray, S.L.; Goodrich, L.F.; Dube, W.P. (Center for Electronics and Electrical Engineering, National Bureau of Standards, Boulder, Colorado 80303). *Review of Scientific Instruments;* **60**: No. 2, 261-264(Feb 1989).

To measure the critical current of superconductors, a high output current supply is required. In addition to high current capability, the supply should be designed to reduce ground loop problems, respond linearly to an input control signal, and minimize output noise. A current supply with these qualifications has been constructed and tested. Although the supply was originally designed for testing conventional superconductors at high current levels, it has also been successfully used in measurements on the high-critical-temperature ceramic superconductors where the maximum current output was less than 1 A. The supply can produce 1000 A output current with a noise level of approximately 0.05 A peak-to-peak. The specifics of the current supply's design and performance are given.

29 ENERGY PLANNING AND POLICY

11155 **(PB—89-125546/XAB) Soviet military terminology. Volume 1, A-M, Volume 2, N-R, Volume 3, S-Z. September 1988. Second edition. Reference aid.** (Foreign Broadcast Information Service, Washington, DC (USA)). Sep 1988. 1756p. NTIS PC$116.95/MF$42.50.

The Soviet Military Terminology (SMITE) project is a computerized Russian-English dictionary containing comparative definitions of Soviet and U.S. military terms. The purpose of SMITE is: (1) to standardize the Russian military translations of FBIS translators; (2) to define differences in elusive U.S. and Soviet military concepts for analysts; and (3) to provide a computerized dictionary (terminology bank) that can be modified quickly to accommodate new Soviet military terms and revised definitions of Soviet military concepts in the light of new data. Unlike the entries of other military dictionaries, definitions in SMITE are cross-referenced to re-

lated terms in the data base so that analysts or translators can pinpoint the nuances of similar terms.

2902 Economics And Sociology

REFER ALSO TO CITATION(S) 10703, 10725, 10727, 10833, 11165, 11172, 11177, 11187, 11199, 11271, 11286, 11618, 11837

11156 **(DOE/EIA—0466(87)) Profiles of foreign direct investment in US energy, 1987.** (USDOE Energy Information Administration, Washington, DC. Office of Energy Markets and End Use). Dec 1988. 36p. NTIS, PC A03/MF A01 - GPO - OSTI; 1; GPO Dep. Order Number DE89005022/JAW.

In accordance with Section 657, Subpart 8, of the Department of Energy Organization Act, the Energy Information Administration (EIA) prepares an annual report for the Secretary of Energy and for transmittal to Congress. This report summarizes the activities in the United States by foreign-affiliated companies that own or control US energy sources and supplies. This report presents the following profiles for 1987: Foreign direct investment in US petroleum, including natural gas; The energy production, processing, distribution, and reserves of foreign-affiliated companies; The financial performance and investment activity of foreign-affiliated energy companies; Overseas oil and gas operations of US companies; and Comparisons of foreign-affiliated companies with US energy companies. The information is intended for use by the Congress, Government agencies, energy industry analysts, international trade and finance analysts, and the public. 13 refs., 5 figs., 20 tabs.

11157 **(INIS-mf—11892) Our responsibility with regard to the energy problems.** (Studentenmission in Deutschland (SMD), Marburg (Germany, F.R.)). [1988]. 87p. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88756506/JAW.

SMD-Materialien. Referate - Protokolle - Berichte.; no. 1.

The working groups of the Students' Mission in Germany (SMD) intend among others to initiate and to foster among the students and their Christian associations interest in and discussions on current topics of the society, based on the scientific and the Christian approach. So the information brochure in hand presents subject-related information together with and discussed with a view to Christian duty, to fulfil the task given to man by the Creator, namely to understand the earth and nature as companions. The contributions are written by three natural scientists and a theologian, the subjects include: The ecologic crisis - a substantial challenge to our idea of life and our way of life; belief in the word of God and technical and scientific knowledge; energy scenario for the Federal Republic of Germany; about energy conservation; ecologic aspects of the energy problem; economic aspects illustrated by the example of the district heat supply. (HSCH).

11158 **(ORNL/TM—10948) Socioeconomic assessment of the proposed inactivation of the 5th Fighter Interceptor Squadron Minot Air Force Base, North Dakota.** Kerley, C.R.; Sage, P.L.; Fichera, J.P.; Lufkin, P.; Stadelman, D. (Oak Ridge National Lab., TN (USA)). Dec 1988. Contract AC05-84OR21400. 103p. NTIS, PC A06/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005691/JAW.

This assessment examines the potential socioeconomic impacts of inactivating the 5th Fighter Interceptor Squadron (FIS) at Minot Air Force Base (AFB), North Dakota. The study focuses on employment, population, and income impacts and estimates their effects on housing, community services, utilities, transportation, recreation and tourism, and public finance. This assessment is intended primarily for the use of Air Force and community planners concerned with the local consequences of the inactivation. 10 refs., 46 tabs.

11159 **(STEV—1988-7) Electricity prices and Swedish industry.** (Statens Energiverk, Stockholm (Sweden)). 1988. 330p. (In Swedish). NTIS (US Sales Only), PC A15/MF A01. Order Number DE88755873/JAW.

In the light of the decision to phase out nuclear power by year 2010 from the Swedish energy system, the effects of increased costs for electric power on the Swedish industry are studied in the report. Possibilities of more efficient electricity use as well as structural changes in the industry are treated. It is concluded that electricity-intensive industry can suffer a lot, and possible counter-measures to alleviate these problems are discussed. Detailed effects for different branches of the industry are reported, including the effects on employment. (G.B.).

11160 **(STEV—1988-8) Value added tax on energy.** (Statens Energiverk, Stockholm (Sweden)). Jun 1988. 191p. (In Swedish). NTIS (US Sales Only), PC A09/MF A01. Order Number DE88755874/JAW.

This report discusses the probable effects of replacing the Swedish excises on energy with a value added tag, the grounds for such a tax reform and certain efficiency aspects. In general, the effects seem to be positive, although some incentives to stimulate the use of the environmentally preferable fuels are needed. An international review of the energy taxation is also given. (L.E.).

2903 Environment, Health, And Safety

REFER ALSO TO CITATION(S) 10699, 10790, 11157, 11166, 11173, 11185, 11193, 11552, 11618, 11711, 11730, 11776, 11777, 11783, 11814, 11815, 11816, 11820, 11922, 11923, 11924, 11925

11161 (NHR—1988, pp 25-35) **Climate change and water resources.** Hengeveld, H.G. (Canadian Climate Centre, Downsview, Ont.). [1988]. Environment Canada, Document, Text and Library Services, Terrasses de la Chaudiere, 10 Wellington St., Ottawa, Ont., Canada K1A 0H3; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN. (CONF-8711266—; MICROLOG—88-03679).

From Symposium on interbasin transfer of water: impacts and research needs for Canada; Saskatoon, Canada (9 Nov 1987).

A basic assumption underlying most studies into water resource planning and management is that climate is relatively constant--that the past is a reliable predictor for the future. During the past decade, studies into the behavior of the global climate system strongly imply that this assumption is no longer valid. A major planetary-scale climate change, induced by human activities and the greenhouse effect, may in fact already be in progress. Within the next century, such changes are expected to reach proportions unprecedented in human history. As the global temperature pattern changes, so will the hemispheric wind patterns, the storm tracking, the rainfall distribution and regional soil moisture/runoff characteristics. Although the details of such changes on a regional scale are still highly uncertain, the implications for long-term water resource planning are profound. This paper will review the scientific basis for climate change projections, present a range of possible climate scenarios for Canada that may emerge in coming decades and identify some of the implications for water resource demand and management. Two primary conclusions are: Canada's climate will be much warmer, with some areas becoming wetter and others drier; and Canada's water resources will undergo a redistribution, with less in the south and more in the north as a probable outcome. Related economic implications are briefly discussed. 13 refs., 4 figs., 2 tabs.

11162 **(ORNL—6450/R11) Environmental Regulatory Update Table, November 1988.** Houlberg, L.; Langston, M.E.; Nikbakht, A.; Salk, M.S. (Oak Ridge National Lab., TN (USA)). Dec 1988. Contract AC05-84OR21400. 95p. NTIS, PC A05/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005703/JAW.

The Environmental Regulatory Update Table provides information on regulatory initiatives of interest to DOE operations and contractor staff with environmental management responsibilities. The table is updated each month with information from the Federal Register and other sources, including direct contact with regulatory agencies. Each table entry provides a chronological record of the rulemaking process for that initiative with an abstract and a projection of further action.

11163 (PB—89-108807/XAB) **Water quantity and quality model for the evaluation of water-management strategies in the Netherlands: application to the province of Friesland.** Brinkman, J.J.; Griffioen, P.S.; Groot, S.; Los, F.J. (Waterloopkundig Lab. te Delft (Netherlands)). Mar 1987. 12p. (DELFT-HYDRAULICS-COM—380). NTIS, PC E03/MF A01.

The Netherlands have a rather complex water-management system consisting of a number of major rivers, canals, lakes and ditches. Water-quantity management on a regional scale is necessary for an effective water-quality policy. To support water management, a computer model was developed that includes both water quality and water quantity, based on three submodels: ABOPOL for the water movement, DELWAQ for the calculation of water quality variables and BLOOM-II for the phytoplankton growth. The northern province of Friesland was chosen as a test case for the integrated model to be developed, where water quality is highly related to the water distribution and the main trade-off is minimizing the intake of (eutrophicated) alien water in order to minimize external nutrient load and maximizing the intake in order to flush channels and lakes. The results of the application of these models to this and to a number of hypothetical future situations are described.

11164 (UNEP-ERS—17-86) **The environmental impacts of production and use of energy. Part IV - comparative assessment of the environmental impacts of energy sources. Phase III - assessment of tools and methods for incorporating the environmental factor into energy planning and decision-making.** (Valtion Teknillinen Tutkimuskeskus, Espoo (Finland)). Jun 1986. 97p. Valtion Teknillinen Tutkimuskeskus, Espoo (Finland).

This report aims to describe the present situation with regard to incorporating the environmental factor into the energy system planning process and to give some guidance as to how to proceed with planning electric power stations in the absence of applicable well developed methods. The report includes a discussion of a number of available energy-environment models, these being the set of energy-environment models developed jointly by the University of Wisconsin and the International Institute for Applied Systems Analysis (IIASA), and those employed in two case studies dealing with electricity production for a rapidly growing city in a developing country and sulphur emissions from energy production in a developed country respectively. Energy-environment optimization models are also discussed.

2904 Natural Resources

REFER ALSO TO CITATION(S) 11602, 11813

11165 (ACUNS—88, pp 533-539) **Attitudes about sustainable development in Yukon.** McRobert, D. (York Univ., Ontario). 1988. Association of Canadian Universities for Northern Studies, 130 Albert Street, Ottawa, Ont., Canada K1P 5G4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN. (CONF-8511343—; MICROLOG—88-02606).

From National student conference on northern studies; Ottawa, Canada (18 Nov 1985).

In June 1986 the Yukon Territorial Government (YTG) released a draft discussion paper on prospects for a more sustainable economic development policy entitled Yukon 2000. The ideas in that document and several other recent initiatives in the areas of renewable resource management and import substitution provided the inspiration for this research. The aim of the study was to determine whether these recent policy initiatives were understood and supported by Yukoners. A questionnaire was designed and thirty policy-makers, opinion-formers and "stakeholders" in government, industry, the native community and environmental groups were interviewed. This paper surveys some of the preliminary results obtained in the study. The results suggest that respondents believe that Yukoners support measures such as import substituion. In addition, most of those interviewed believe that a slower pace of both economic development and population growth is preferable because this would allow Yukoners to maintain greater control over key decision-making processes and reduce the impact of the boom and bust cycle. However, it was also clear that a wide discrepancy existed over the interpretation of certain key aspects of the YTG initiatives and this, in turn, indicates that the YTG should increase public education activities to inform Yukoners about the different policy options related to the Yukon 2000 project specifically and sustainable development in more general terms. 48 refs., 2 tabs.

11166 (EC/FO—FS23-121/1987E) **Canadian Arctic marine conservation strategy: discussion paper.** (Environment Canada, Ottawa, Ontario. Fisheries and Oceans). 1987. 16p. (MICROLOG—88-02215). Environment Canada, Document, Text and Library Services, Terrasses de la Chaudiere, 10 Wellington St., Ottawa, Ont., Canada K1A 0H3; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

This document presents an outline of Canada's Arctic Marine Conservation Strategy (AMCS) and its implementation. The AMCS is to serve as a step in ensuring sustained use of renewable resources and a careful balancing of industrial activities such as hydrocarbon development, community developments, and the pursuits of both hunting and fishing. The AMCS provides an overall framework within which Arctic marine resources should be managed. It provides for conservation and management of Arctic marine ecosystems, both to preserve the quality of the marine environment and to conserve the renewable resources which are an integral component of it. The AMCS and its implementation will be guided by the principles of Canadian sovereignty, benefit to society, maintenance of ecology and genetic diversity, use of an ecosystems approach and integrated management of renewable and nonrenewable resource activities, sustainable resource utilization, and recognition that the Inuit have particular rights and responsibilities. The Strategy will promote development of knowledge and understanding of marine systems and resource use, and will be built through consensus and mutual understanding with the user community. Implementation of AMCS will use existing institutions and processes wherever possible, through a series of action plans which will be developed from the strategies outlined in this document. These strategies include scientific research programs, shared management processes, integrated conservation and management planning, and a system of marine protected areas in the Arctic.

11167 (NEI-DK—115) **Report for the period 1. July 1987 - 30. June 1988 from the Mineral Resources Administration in Greenland.** (Raastofforvaltningen for Groenland, Copenhagen (Denmark)). 1988. 75p. (In Danish). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88755796/JAW.

In 1979 Home Rule was introduced in Greenland. In the same year and in relation to the revision of the law on Greenlands mineral resources a Joint Council specializing in this subject, was established. The establishment and administration of this Council is described in detail. For some years the Danish Government and the Home Rule have been negotiating on agreements regarding Greenlands raw materials, and these negotiations are elucidated closely. The discovery of Cryolite in Greenland is touched upon. A very detailed list of projects, proposed, current and completed, and of applications from foreign firms wishing to make underground investigations to establish the extent of the mineral resources, is given. (AB).

11168 (NHR—1988, pp 137-152) **The Kemano diversion. A hindsight assessment.** Gomez-Amaral, J.C.; Day, J.C. (IBM Mexico Scientific Center, Col. Palanco, Mexico; Simon Fraser Univ., Burnaby, B.C.). [1988]. Environment Canada, Document, Text and Library Services, Terrasses de la Chaudiere, 10 Wellington St., Ottawa, Ont., Canada K1A 0H3; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN. (CONF-8711266—; MICROLOG—88-03679).

From Symposium on interbasin transfer of water: impacts and research needs for Canada; Saskatoon, Canada (9 Nov 1987).

Industrial and social objectives of the 1950 Kemano (British Columbia) project were fulfilled by building an ambitious engineer-

ing undertaking which increased Canadian hydroelectricity generation, aluminum smelting capacity, and created new centers of population in a remote region. However, significant biophysical and social impacts were induced such as the loss of fish habitat, drowned forests, and the forced relocation of local Indian bands. A cost-benefit analysis reveals that overbuilding and declining aluminum prices made the project uneconomic from a social perspective. A tripartite Nechako River Flow Agreement was finalized in 1988 which permitted an increase in the diversion of the Nechako while protecting downstream Chinook salmon, in return for no further direction of the Manika River into the Nechako. All public interest groups were excluded from those negotiations. There was no effort made to redress losses experienced by the Cheslatta Band, which had been displaced from its lands 35 years earlier with only marginal compensation. Project impacts were not adequately managed by today's standards. To avoid such impacts which disadvantage specific social groups, recommendations are made to create a multilateral resource management committee. 35 refs., 2 figs., 1 tab.

11169 (NHR—1988, pp 43-56) **Dams and diversions: learning from Canadian experience.** Day, J.C.; Quinn, F. (Simon Fraser Univ., Burnaby, B.C.). [1988]. Environment Canada, Document, Text and Library Services, Terrasses de la Chaudiere, 10 Wellington St., Ottawa, Ont., Canada K1A 0H3; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN. (CONF-8711266—; MICROLOG—88-03679).

From Symposium on interbasin transfer of water: impacts and research needs for Canada; Saskatoon, Canada (9 Nov 1987).

The geography of Canada is such that water can almost everywhere be dammed and diverted readily between drainage basins. Engineers have responded, especially in recent hydroelectric megaprojects, to push interbasin diversion volumes well above those experienced in any other country. The pace has slowed, however, with rising construction costs, stabilizing energy demands and persistent interventions by natives and environmental critics. An exploration of politics, policies and public attitudes indicates reservations about this kind of development throughout the continent. Some lessons of a socioeconomic nature are ventured for consideration, in the event that major diversions are proposed to resume in the future. These include the need for an exploration of alternatives to diversion, careful assessment of the project economics, and mitigation of impacts on local residents. 11 refs., 1 fig., 1 tab.

11170 **(NHR—1988) Proceedings of the symposium on interbasin transfer of water: impacts and research needs for Canada.** Nicholaichuk, W. (ed.); Quinn, F. (ed.). (National Hydrology Research Inst., Ottawa, Ontario (Canada); Canadian Water Resources Association, Lethbridge, Alberta). [1988]. 488p. (CONF-8711266—; MICROLOG—88-03679). Environment Canada, Document, Text and Library Services, Terrasses de la Chaudiere, 10 Wellington St., Ottawa, Ont., Canada K1A 0H3; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

From Symposium on interbasin transfer of water: impacts and research needs for Canada; Saskatoon, Canada (9 Nov 1987).

The volume of water transferred between drainage basins in Canada is larger than in any other country in the world. The recent slowdown in the growth of water demand for agricultural and energy production has provided an opportunity to reassess economic, social and environmental realities of such transfers. A symposium was conducted to examine the scientific uncertainties related to interbasin transfer. Objectives of the symposium were to compare experiences with different kinds of interbasin transfer across Canada, including hydrological, morphological, engineering, biological, social, legal, economic, and political aspects; to review the adequacy of pre- and post-project monitoring activities in support of more comprehensive assessment of project impacts; and to identify the data and research needed to improve understanding of the implications of water transfer in terms of natural processes, social values, and policy alternatives. Papers were presented on the GRAND Canal Project, regional experiences with interbasin transfer, environmental assessment, quantity modifications, water quality and environmental modifications, biological issues, and institutional issues. Separate abstracts have been prepared for ten papers from this symposium.

11171 **(NIVA-O—85277) Planning and amalgamation by watercourse development.** Boerset, E. (Norsk Inst. for Vannforskning, Oslo). Aug 1986. 68p. (In Norwegian). NTIS (US Sales Only), PC A04. Order Number DE88755835/JAW.

The report discusses the planning process of watercourse development, and focuses on the experiences gained from the development of consequence analyses systems, water use planning, and the Master Plan for Water Resources in Norway. A particular attention has been laid on the amalgamating- and counterbalancing part of the planning process, and what kind of assumptions one has to take into consideration. A decision making plan is recommended on the basis of the "Planning-Balance Sheet" method. The various elements and indicators to be used in the process are described. 12 figures, 7 tables.

11172 **(PB—89-106595/XAB) Managing natural resources for sustainable development. Special report.** Chase, S.; Irving, E.; Long, N.; Pinkelman, J. (Agency for International Development, Washington, DC (USA)). 1987. 53p. (AID-PN-AAZ—253). NTIS, PC A04/MF A01.

Color illustrations reproduced in black and white.

The report presents an overview of A.I.D. efforts, which encompass a wide range of environmental issues and support environmental training, research, and institutional development. The report's opening section details A.I.D.'s efforts to enlist host-country support for environmental programs, with specific emphasis on improving natural resource management (especially in Africa), encouraging policy change, strengthening the private sector's environmental role, and preparing environmental profiles of host countries and helping them develop conservation strategies. The ensuing sections recount A.I.D. efforts in particular topics of environmental concern (biological diversity and environmental health and safety), critical ecological areas (coastal areas and forests and fragile lands), and specific country programs (reforestation in Haiti). A brief history of the evolution of the Agency's environmental strategy since 1976 is included.

11173 **(PB—89-107296/XAB) Environment and natural resources. Policy paper.** (Agency for International Development, Washington, DC (USA)). Apr 1988. 18p. (AID-PN-AAV—464). NTIS, PC A03/MF A01.

A.I.D. policy on natural resources and the environment aims at promoting environmentally sound, long-term economic growth by helping developing countries conserve and protect the environment and manage their exploited resources for sustained yields. Assistance focuses on: sustainable production, maintaining natural ecosystems, and meeting human needs by improving environmental quality. Within these areas, A.I.D. will support forestry, soil conservation and watershed management, resource inventories, environmental planning and education, land use planning, rangeland management, water and wastewater treatment systems, improved industrial and urban pollution control, and coastal resources management. A.I.D.'s policy, activities, and regulations are detailed, including cooperation with other donors and development banks in promoting environmental activities. Annexes also are included.

2905 Research, Development, Demonstration, And Commercialization

REFER ALSO TO CITATION(S) 10619, 10838, 10942, 11190, 11213, 11890

11174 **(DOE/CE/64610—T1) Developmental state program for institutional conservation: Final report.** (Colorado Office of Energy Conservation, Denver (USA)). 1988. Contract FG01-86CE64610. 161p. NTIS, PC A08/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004157/JAW.

The Colorado Office of Energy Conservation (OEC) accepted proposals to offer energy management services to schools and hospitals in Colorado. This was a demonstration project designed to provide energy management technical assistance and services to groups of institutions. The solicitation was aimed at organizations

that offered services to groups of institutions, such as, school district Boards of Cooperative Educational Services, hospital associations and Energy Offices. The OEC had $180,000 available to fund up to six organizations for one year. A 20% match was required. Energy management services that were considered when evaluating the proposals were: energy audits; operations and maintenance procedures planning, training, and implementation; energy construction and project management; and energy accounting services. From the initial proposal solicitation, we received five proposals, one of which was acceptable. When a survey was done to determine the reason for the poor response, it was found the timing was bad because it was during the year-end holidays, too much specific information was requested and some of the organizations felt if their participating members had wanted this service they would have asked. This report is a description of the Scope of Work of each of the contractors and what each of them accomplished over the course of their contract. 21 refs.

11175 **(EFN—28) INNOVA. An investigation of the innovation process.** Gustavsson, P.; Hoegberg, B. (ConNova, Stockholm (SE)). (Energiforskningsnaemnden, Stockholm (Sweden)). 1987. 220p. (In Swedish, English). NTIS (US Sales Only), PC A10/MF A01. Order Number DE88755767/JAW.

The objective has been to identify important factors in the innovation process that result in successful innovations. The starting point for identification has consisted of ten case studies of a similar number of innovations within the energy sector, linked to Swedish companies that are either partly or wholly active within the energy sector. Factors that the investigators found to have played an important part in the success of their respective projects have then been isolated from the case studies and arranged and related to more general innovation theory. A questionnaire survey work was carried out between May and September 1985, and complementary interviews and analysis work during 1986. The interviewees were asked to name good innovations of various kinds that had reached the market since the oil crisis of 73/74. From the replies, ten examples of sound innovations have been selected: Large heat pumps using effluent as their heat sources. Domestic heat pumps with outdoor air collectors. Circulating fluidised bed combustion. Flue gas cooling and condensation. Asea Master computerized control system. Ventilation monitoring systems. Thermo-mechanical pulp. Gas-insulated switchgear. Submersible turbines. Boilers for interruptable and power supplies. In almost all cases, innovations were developed from existing knowledge from within the ten companies. The ten innovations were generally introduced to relatively structured markets, which means that there was seldom any need to create a new market structure. State support for test and demonstration projects probably also played an important part in providing observability and reducing uncertainty. (authors).

11176 **(IfB-F—631) Evaluation of foreign research reports on innovative heat supply technologies.** Zapke, W.; Ebert, H. (Institut fuer Bauforschung e.V., Hannover (Germany, F.R.); Bundesministerium fuer Raumordnung, Bauwesen und Staedtebau, Bonn (Germany, F.R.)). Jun 1983. 343p. (In German). Copy held by UB/TIB Hannover.

Evaluations of foreign research reports intend to facilitate access to complex and difficult-to-get-hold-of data and facts. The study is closely related both to research report F 577 'Evaluation of foreign research reports on heating systems' covering the literature published from 1968 to 1974 and to research report F 482 'Evaluation of foreign research reports on heating systems, continued', referring to the reports compiled from 1974 to 1978. While F 577 and F 482 are of the global kind, the 1983 study is limited to innovative technologies, their state of the art and future trends.

11177 **(LA—10886-MS) Employment-generating projects for the energy and minerals sectors of Honduras.** Frank, J.A. (Los Alamos National Lab., NM (USA)). Dec 1988. Contract W-7405-ENG-36. 153p. (EN;SP). NTIS, PC A08/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005542/JAW.

A mission to Honduras invited by the Government of Honduras and sponsored by the Organization of American States addressed the generation of employment in various areas of interest to the country. The mission was made up of experts from numerous countries and international agencies. In the energy sector, the mission recommended consolidating the sector under a coordinating body; carrying out projects to promote reforestation, tree farms, and rational forest utilization; encouraging industrial energy conservation; developing alternative energy sources; and promoting rural electrification and expansion of the electrical grid. In the mining sector, the mission supported promotion and technical assistance for small gold-leaching and placer operations, the national mineral inventory, detailed exploration of promising sites, and the development of a mining school. 13 refs., 7 tabs.

11178 **(RISO-R—560) Meteorology and Wind Energy Department annual progress report. 1 Jan - 31 Dec 1987.** Petersen, E.L.; Skrumsager, B. (eds.). (Risoe National Lab., Roskilde (Denmark)). May 1988. 88p. NTIS (US Sales Only), PC A05/MF A01. Order Number DE88755850/JAW.

The research in the Department of Meteorology and Wind Energy is directed towards two major applications: wind energy and modelling air pollution dispersion. In order to maintain a high level of technical competence within these applications, the department has carried out both theoretical and experimental basic studies. The subjects range from surface energy balance research of the general spatial and temporal structure of atmospheric turbulence to wind engineering investigations of dynamic loads on buildings, bridges, and other structures. Very important parts of the applied work are the testing and licensing of wind turbines for the Danish market and providing consultative services for Danish wind turbine manufactures. (author) 8 tabs., 30 ills., 28 refs.

11179 **(SNV—3516) Effects of air pollutants and acidification. Research programme for the period 1988-89 to 1992-93.** (National Swedish Environmental Protection Board, Solna). Jun 1988. 33p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755867/JAW.

The research program concerns the National Environmental Protection Board project 'Effects of air pollutants and acidification' for the period 1988/89-1992/93, which is the third five year period for the project. The program is accepted by the research council of the protection board. The purpose of the program is to, by intensified efforts of research, try to explain and quantify effects of air pollution and acidification on forest, fauna and flora, ground and subsoil water. Emphasis is laid upon the kind of knowledge needed for prediction of effects at different alternatives of strain and during different time periods, and also to improve the basis of knowledge before making decisions and taking international action. The program emphasizes seven areas of problem given priority to; * Ground- and subsoil acidification, * The mobility of metals and metalloids, * Effects of ground acidification on the vitality of the forest, * Effects of nitrogen storage on forest ground, * Ozone, organic compounds and forest damage, * Effects of air pollution on fauna and flora, * Relation air pollution-forest growth.

11180 **(STU-I—673-1988) Effectual energy technology. Program planning of R and D efforts 1987/88 - 1989/90.** (Swedish National Board for Technical Development, Stockholm). Mar 1988. 40p. (In Swedish). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755910/JAW.

The plans are briefly summarized under the following headings: Main program 1. Industrial energy consumption, Subprogram 1. Energy consumption in process industry, 1.1 Electricity efficient processes, 1.2 Heat efficient processes, 1.3 Energy production and energy products within process industry, Subprogram 2. Joint energy technologies, 2.1 Thermal engineering, 2.2 Separation technology, 2.3 Combustion, 2.4 Electrical engineering etc., 2.5 Energy caused materials technology, 2.6 Materials recovery, 2.7 Catalysis, 2.8 Industrial hydrodynamics, 2.9 Industrial gas engineering. Main program 4. Energyrelated fundamental research. 1. Surface physics, surface chemistry and surface processes and surface properties of importance from energy technology point of view, 2. Photo-electrochemistry, 3. Fundamental studies of selective radiation absorption and transmission, 4. Miscellaneous. Energy technology for transport. -Technical systems analysis, -Fuels, -Propulsion systems.

11181 **(UCRL—52000-88-10) Energy and technology review.** Poggio, A.J. (ed.). (Lawrence Livermore National Lab., CA (USA)). Oct 1988. Contract W-7405-ENG-48. 48p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005308/JAW.

This issue of Energy and Technology Review contains: Neutron Penumbral Imaging of Laser-Fusion Targets--using our new penumbral-imaging diagnostic, we have obtained the first images that can be used to measure directly the deuterium-tritium burn region in laser-driven fusion targets; Computed Tomography for Nondestructive Evaluation--various computed tomography systems and computational techniques are used in nondestructive evaluation; Three-Dimensional Image Analysis for Studying Nuclear Chromatin Structure--we have developed an optic-electronic system for acquiring cross-sectional views of cell nuclei, and computer codes to analyze these images and reconstruct the three-dimensional structures they represent; Imaging in the Nuclear Test Program--advanced techniques produce images of unprecedented detail and resolution from Nevada Test Site data; and Computational X-Ray Holography--visible-light experiments and numerically simulated holograms test our ideas about an x-ray microscope for biological research.

2906 Nuclear Energy

REFER ALSO TO CITATION(S) 10790, 11159, 11185, 11552, 11820

11182 **(INIS-mf—11885) Opinions and statements of the experts who studied the framework conditions of abandonment of nuclear power - presented by the commission set in by the OeTV Executive Board (Public Services and Transport Workers' Union). Decisions - recommendations - positions.** (Gewerkschaft Oeffentliche Dienste, Transport und Verkehr (OeTV), Stuttgart (Germany, F.R.). Hauptvorstand). Oct 1987. 287p. (In German). NTIS (US Sales Only), PC A13/MF A01. Order Number DE88756501/JAW.

The publication consists of two volumes and explains the position and opinions of the OeTV Executive Board concerning abandonment of nuclear power. The first volume presents the Executive Board's statement given in September 1987: Nuclear power should be abandoned, and it can be done; energy policy has to take a new line, concentrating on energy conservation, enhanced use of coal for electricity generation, enhanced use of renewable energy sources; stepwise shutdown of nuclear power stations. The first volume also presents the documents and experience forming the basis of the Union's position, namely the expert opinions on this issue, and an information visit to Sweden together with a report of Sweden's Minister of Industry on effects of the Chernobyl reactor accident. The development of the Union's point of view of energy policy since the year 1976. (HSCH).

2907 Transport And Storage

11183 **(KTM/E-D—156) Experimental building of the heat storage in Lahti.** Kuusela, P.; Nikkanen, A. (Valtion Teknillinen Tutkimuskeskus, Espoo (Finland). Saehkoetekniikan Laboratorio). (Kauppa-ja Teollisuusministerio, Helsinki (Finland). Energiaosasto). Apr 1988. 87p. (In Finnish). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88755776/JAW.

Building and operation of a large heat storage is discussed in this report. The heat storage is in Lahti. The storage is a cylindrical, water filled, unpressurized and insulated steel tank with a volume of 10.000 m/sup 3/. The tank is connected directly to the district heating system so the water of the district heating network can circulate through the tank. When the storage is charged, hot water is lead into the top of the tank and cool water in lower part of the tank is lead out. When discharging the storage is working conversely. Heat effect of the 10.000 m/sup 3/ storage is 40 MW with 40 deg C temperature difference which means 450 MWh heat capacity. The heat storage is used since March 1985. The investment cost was FIM 4.2 millions and net incomes were in 1985, -86 and -87 FIM 480 (9 month), 555 and 915 thousand. After three years operation 8 years pay-back time is estimated when rate of interest is 10%. In the 1987 the storage was discharged 39.4 GWh, which means 1978 utilization hours of maximum heat load. Period of charge-discharge is 2.1 days in average. Heat los is 1% of discharged heat energy a year, so the average heat los effect is 12.8 W/m/sup 2/,a. Pumping energy is also about 1% of discharged heat energy. Temperature layers keep well in the tank. When charging or discharging the storage the hot water changes more slowly in the corners of the tank and in the cylindrical space between the upper and lower diffusors as in other parts of the tank. Temperature difference goes 0.6 deg C/day lower in the gradient layer. The temperature gradient layer is about one metre high growing higher in the course of time. Stresses in the tank shell were analysed and the life time of the tank is at least 20 years.

2908 Waste Heat Utilization

REFER ALSO TO CITATION(S) 11267, 11278

2910 Conservation

REFER ALSO TO CITATION(S) 11174, 11185, 11240, 11255, 11256, 11258, 11278

11184 **(NP—9770193) Financial aid to energy conservation measures by the state of Baden-Wuerttemberg.** (Landesgewerbeamt Baden-Wuerttemberg, Stuttgart (Germany, F.R.). Zentrale Informationsstelle fuer Energiefragen (ZIE)). 1986. 13p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE89770193/JAW.

The state of Baden-Wuerttemberg, the Federation and the European Community provide support, through varied programmes, for energy-saving investments, advice to businesses, studies and investigations and demonstration projects, among other things, in order to reduce energy consumption in industry. The most important promotional programmes are presented in abbreviated form in 10 tables. The measures offered here by a state-run energy conservation programme are directed mainly at small and medium-sized industrial enterprises. Tradesmen and entrepreneurs in small businesses are asked to use these opportunities to improve their productivity and competitiveness.

2920 Supply, Demand, And Forecasting

REFER ALSO TO CITATION(S) 10731, 11186, 11195

2930 Policy, Legislation, And Regulation

REFER ALSO TO CITATION(S) 10699, 10763, 10764, 10765, 10766, 10767, 10768, 10769, 10770, 10771, 10772, 10773, 10774, 10775, 10776, 10777, 10778, 10779, 10780, 10861, 11162, 11193, 11202, 11203, 11552, 11699

11185 **(DOE/S—0068) United States energy policy, 1980--1988.** (USDOE, Washington, DC). Oct 1988. 175p. NTIS, PC A08/MF A01 - OSTI. Order Number DE89002847/JAW.

This report reviews the nation's energy policy over the past several years. It looks at how domestic oil, energy efficiency, natural gas, nuclear energy, and renewable energy resources can help maintain and enhance our energy security. It surveys advances in energy technologies from enhanced oil recovery to new clean coal processes. It also describes the federal research programs in the basic energy sciences and it outlines the environmental issues that may profoundly affect our future energy choices.

11186 **(NEI-NO—54) Energy scenarios for the year 2000.** Borring, J.; Kristiansen, A. (Oslo Univ. (Norway). Raadet for Natur- og Miljoefag). Feb 1988. 50p. (In Norwegian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755823/JAW.

This report is based on a Report to the Storting (Parliament) on Norway's energy use and production in the year 2000. In the present report alternative ways of meeting the energy demand are pointed out, by using natural gas, biomass, energy conservation, heat pumps and solar energy. These alternatives may be used to

substitute parts of the electric power and the oil consumption. An analysis is given of alternative energy scenarios for the year 2000, and their consequences with regard to effluent reductions and energy costs. It is also examined how gas power most favorably can be fit into the Norwegian energy supply system to meet the peak load requirements. 25 refs., 2 figs., 7 tabs.

2940 Fossil Fuels

REFER ALSO TO CITATION(S) 10619, 10700, 10701, 10702, 10720, 10721, 10722, 10723, 10729, 10730, 10731, 11185, 11186, 11200, 11606, 11606, 11607, 11607, 11608, 11608, 11609, 11609

11187 (DM—7705) Price elasticity of demand for transportation fuels. (DataMetrics Ltd., Calgary, Alberta (Canada)). 1977. 125p. (CE—02201). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

This study attempts to estimate the degree of response of fuel consumption in the Canadian transportation sector to variations in fuel prices. Analysis is confined to selected mode-fuel combinations which account for most transport fuel used and for which data are available: rail-, truck-, and bus-diesel; water-fuel oil; domestic air-turbo fuel; and automobile-gasoline. The methodology used in the study involves estimation of aggregate models over different time periods: a long-run annual model (1960-75 data) and a short run model using quarterly data over the 1970-75 period of sharply rising fuel prices. In estimating consumption/price relationships, two-stage models were estimated for each mode. The first stage treats a transportation output quantity (e.g. ton-miles) as a function of such variables as industry activity levels, population, income, and a price index. The second stage treats modal fuel consumption as a function of the output variable given by the first stage and the price of the relevant fuel. The results of this equation provide estimates of the price elasticity of fuel consumption. The exception to this procedure is the auto mode, where certain aspects of the gasoline market are taken into account. A major constraint on the analysis was the availability of suitable data. However, interesting results were obtained for some mode-fuel combinations. It was expected that demand for transportation fuels would be price inelastic since fuel costs are a small part of total transport costs. Overall, it is found that those estimates of price elasticity that have been able to be derived are in accord with theoretical expectations, except for the auto-mode long-run model. 13 tabs.

11188 (NEI-NO—59) Long-range perspective - Factors affecting the planning committee in future. Sitje, O. (9847200NO;). (Norsk Petroleumsforening, Oslo). 1985. 33p. (In Norwegian). (CONF-8511344—5). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755828/JAW.

From New development solutions on the Norwegian continental shelf in the next 10 to 15 years - consequences/possibilities for the Norwegian offshore industry; Trondheim, Norway (25 Nov 1985).

The report concerns the future development of the Norwegian continental shelf with respect to the new types of facilities and systems designed for deep water conditions. The long-range perspectives are discussed, and the various factors affecting the planning committee are given. The proven resources of oil and gas are presented. 10 drawings.

11189 (NEI-NO—60) Tunnel solutions. Holestoel, K. (Petromine A/S, Blommenholm (Norway)). (Norsk Petroleumsforening, Oslo). 1985. 13p. (In Norwegian). (CONF-8511344—6). NTIS (US Sales Only), PC A03. Order Number DE88755829/JAW.

From New development solutions on the Norwegian continental shelf in the next 10 to 15 years - consequences/possibilities for the Norwegian offshore industry; Trondheim, Norway (25 Nov 1985).

The report concerns the future development of the Norwegian continental shelf with respect to the new types of facilities and systems designed for deep water conditions. An oil mine concept with ancillary engineering is presented. The concept comprises a system of tunnels and cavities under the sea bed together with tunnels from the shore for the production/processing and transport of oil and gas. 8 drawings, 1 table, 20 references.

11190 (RFW—8010) Alternative liquid fuel R&D program. Part 2. A federal proposal. (Webb (R.F.) Corp. Ltd., Ottawa, Ontario (Canada)). 1980. 128p. (CE—02124). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

Proposals are outlined for a Canadian federal research and development program in alternative fuels for the 1980-1990 period. Lists of projects are presented under catagories limited primarily to liquid fuels, excluding items related to improving oil recovery processes and to energy conservation. The projects are evaluated and priorities assigned using a check list to identify the major factors involved in determining the technical and economic feasibility of each project; priority assignment criteria for product-oriented projects provide measurements such as cost/benefit ratios, return on investment, and oil savings. For all projects, consideration is given to whether the application has an identified end use and end user, whether government support is needed, applicability to Canada, and timing of the project. For information-oriented projects, criteria involve the importance of the project to achieving objectives such as oil conservation, export potential, job creation, and useability of the project results. The list of projects is classified into those identified by resource utilized (unconventional oil, modified conventional fuels and processes, natural gas/gas liquids, alcohols and derivatives, coal liquids and suspensions, biomass liquids, and others, e.g. hydrogen); those identified by end use (vehicle/fuel interaction, transportation systems, transport/storage/distribution of alternative fuels, and petrochemical/non-transport uses); and those facilitating the development of Canadian alternative fuels capability (liaison and information, facilities and human resource development). 12 tabs.

11191 (STEV—1988-4) International fuel markets. (Statens Energiverk, Stockholm (Sweden)). Jan 1988. 128p. (In Swedish). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88755872/JAW.

The changes in the international fuel markets since the 1970s are described. The main interest is focussed on the petroleum market, but natural gas, LPG and coal are also treated. (L.E.).

2950 Hydrogen And Synthetic Fuels

REFER ALSO TO CITATION(S) 10865, 11190

11192 (NP—9770195) Ad-hoc Committee at the Federal Ministry for Research and Technology: Solar hydrogen-based energy economy. Expertises and scientific contributions. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Apr 1988. 198p. (In German). NTIS (US Sales Only), PC A09/MF A01. Order Number DE89770195/JAW.

The BMFT Ad-hoc Committee invited contributions on the following subjects: (a) energy conversion in fuel cells, (b) utilization of Canadian water resources by means of hydrogen technology, (c) photovoltaics, (d) photovoltaic cost reduction potential, (e) thin film technology, (f) solar energy conversion, (g) the carbon dioxide problem. Chapter one sums up research and development as well as institutional recommendations and presents the data revealing the research and financial incentive expenditures of two different periods of time. Chapter two discusses the present situation of energy economy, the advanced state of the art of hydrogen technology as well as the long-term trends and prerequisites expected to be giving shape to a solar hydrogen-based energy economy. Chapter three describes and justifies the efforts going into the research and development of the relevant technologies.

2960 Electric Power

REFER ALSO TO CITATION(S) 10974, 11182, 11200

11193 (EMR—8809) Canadian electricity policy. (Department of Energy, Mines and Resources, Ottawa, Ontario (Canada)). 1988. 24p. (CE—02129). Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, Ont., Canada K1A 0E4; $N/C.

This document is intended to present Canadian government policy respecting the regulation of electricity exports, the regulation of international and interprovincial power lines, and policies on electricity and the environment. Differences between existing and new policies are explained. In the case of exports and international lines, approval is required from the National Energy Board; the existing policy requires licenses or certificates and Governor-in-Council approval, whereas the new policy is to require a public hearing and Governor-in-Council approval only in designated cases. Authorizations will normally be by permit, not requiring hearings or Governor-in-Council approval. Criteria are outlined to indicate when such approval would be necessary. With respect to interprovincial power lines, the present policy, which does not require National Energy Board certification, except in designated cases, is continued. Environmental policy related to electricity production and transmission is not the exclusive responsibility of the federal government, and a coordinated approach with the provinces and the electric utilities is necessary for development of suitable policy. Appendices to this document list information requirements for permit applicants, terms and conditions for permits, and fair market access guidelines. 4 figs.

11194 (NEI-SE—26) Electric power supply on January, 1987. (Statens Energiverk, Stockholm (Sweden)). 12 Feb 1988. 47p. (In Swedish). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755830/JAW.

January 12, 1987 between 8 and 9 AM the highest load ever in the Swedish electricity distribution system occurred, 26200 MW. The available capacity was 27000 MW. The high load was caused by the extreme cold, on average 20-25 degrees C lower than the January mean temperature. The National Energy Administration does not find it reasonable to dimension the power production system for events like this, but that a series of load management measures should be applied. Furthermore, the new pricing systems that will be introduced 1989 will give the high tension subscribers incentives for smoothening the daily load curves. (G.B.).

11195 (PB—89-118046/XAB) Potential impacts of climate change on electric utilities. Final report. Linder, K.P.; Gibbs, M.J.; Inglis, M.R. (ICF, Inc., Washington, DC (USA)). Dec 1987. 131p. NTIS, PC A07/MF A01.

This report summarizes the analytic approach and preliminary findings of a study jointly sponsored by the Edison Electric Institute, the Electric Power Research Institute, the New York State Energy Research and Development Authority, and the U.S. Environmental Protection Agency. In addition to these organizations, an advisory board of global climate scientists and utility executives provided comment and direction during the design phase of the study. The project examines the potential impacts of greenhouse-gas-induced climate change on the demand for electricity and electric-utility planning and operations in two case studies. The study focuses on the next 30 years, a period of direct relevance to utility planning, but a period of modest temperature changes compared with predictions for the latter part of the 21st Century.

11196 (SV-UE—1988-14) Load management - A way of reducing the costs for electric demand at Gustavsberg VVS AB. Lauber, A.M. (Linkoeping Univ. (SE). Dept. of Mechanical Engineering). (Swedish State Power Board, Vaellingby; Linkoeping Univ. (Sweden). Dept. of Mechanical Engineering). Jan 1988. 97p. (In Swedish). (LiTH-IKP-EX—690). NTIS (US Sales Only), PC A05. Order Number DE88755911/JAW.

Gustavsbergs VVS AB, manufacturer of china sanitary ware and bathtubs, and Vattenfall (Swedish State Power Board) are jointly running a project on energy management at Gustavsberg's industrial plants outside Stockholm. The project started in 1984 and the results so far have been very encouraging. As a consequence a project on load management was initiated by Vattenfall as a thesis project at the faculty of Energy System at the Institute of Technology at Linkoeping. The goal has been to implement a load management program at Gustavsberg VVS AB in order to reduce costs for power demand. Results from mapping and metering the consumption of electricity energy and power demand have been the basis for computerized simulation modelling for load management scenarios. To all appearences, a load management system at Gustavsbergs VVS AB would result in considerable economic savings today and in particular during 1989 when new electricity tariffs will be introduced. Finally, in the light of these facts recommendations for a load management system are given.

11197 (SVF—293) Study of possibilities to increase electric power production in industries and combined power and heating plants by utilizing existing boilers. Wrangensten, L. (AaF Energikonsult AB, Stockholm (SE)). (Stiftelsen foer Vaermeteknisk Forskning, Stockholm (Sweden)). Mar 1988. 53p. (In Swedish). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88755918/JAW.

Calculations have been done for two sizes of steam cycles, Alternative 1, steam production 74 t/h, and Alternative 2, steam production 161 t/h. These alternatives are used to represent existing plants. Two types of fuels, fuel oil and solid wood fuel, are assumed to be used in existing boiler plants. For existing oil fired boilers investment costs for conversion to natural gas firing are included in total costs for gas turbine or diesel engine installation. As an assumption natural gas is used as fuel for gas turbine or diesel engine in economic calculations. The gas turbine and diesel engine installation will raise the power generation efficiency remarkable compared with a single steam cycle (up to 27%). The total efficiency for the combined cycle will decrease slightly (with exception for gas turbine connected to solid fuel boiler) compared with the steam cycle, especially for the diesel engine with a relatively large amount of low temperature waste heat. The power generation cost is estimated to: -gas turbine and solid fuel boiler; between 272-320 SEK/MWh/sub e/ depending on boiler size (running time 4000 h per year). -diesel engine and solid fuel boiler; between 314-333 SEK/MWh/sub e/ depending on boiler size (running time 4000 h per year). If both changing the natural gas price up to 120 SEK/MWh (also valid for LP-gas) and the annuity factor to 0.21 (15 year, 20%) the power price will be between 426-475 SEK/MWh depending on boiler size (running time 4000 h). To install a condensing steam turbine in serial or parallel with existing turbine will render a higher power price than above mentioned, between 379-658 SEK/MWh/sub e/ depending on alternative (running time 4000 h per year)

11198 (OA-Trans—2937) The effects of competition and the EEC internal market on the security of electricity supply. Klaette, G. (Electricity Council, London (UK). Overseas Relations Branch Translations Service). Jun 1988. Translation source information not available. (CONF-8804236—1-Trans). 29p. NTIS (US Sales Only), PC A03/MF A01 - OSTI. Order Number DE89004469/JAW.

From Society for Energy Studies and Energy Policy meeting; Bonn, F.R. Germany (13 Apr 1988).

This paper will therefore attempt to describe the scientific and operational aspects of electricity supply and the effects of enforced competition in terms as simple and comprehensible for the layman as possible, while not departing from the actual facts. This will involve demonstrating the following propositions: electricity is neither a product nor a service in the normal sense; electricity is not supplied by the producer but taken by the customer; power cannot be "wheeled through" a meshed system; the inter-connected system in Western Europe is based on partnership and not competitive rivalry; and competition for individual customers is to the detriment of other electricity consumers and security of supply. 9 figs.

2980 Consumption And Utilization

REFER ALSO TO CITATION(S) 11198, 11259

11199 (DOE/EIA—0040(88)) Typical electric bills: Based on January 1, 1988 rates. (USDOE Energy Information Administration, Washington, DC. Office of Coal, Nuclear, Electric and Alternate Fuels). 27 Dec 1988. 316p. NTIS, PC A14/MF A01 - GPO - OSTI; GPO Dep. Order Number DE89005361/JAW.

The Typical Electric Bills (TEB) annual report is prepared by the Electric Power Division, Office of Coal, Nuclear, Electric and Alternate Fuels, Energy Information Administration (EIA). The publication is designed to be used for applications by government, electric utilities, industry, educational institutions, and consumers. The objective of this report is to present information on the retail cost to residential, commercial, and industrial consumers of electricity for comparable service throughout the United States and Puerto Rico. The bills provided in this report represent typical net monthly electric bills reported by electric utilities based on the specific rate in effect on January 1 of the reporting year that is applicable to the majority of their consumers at specific levels of demand (kilowatts) and consumption (kilowatthours). These bills are those that the electric utilities would have issued had their customers consumed the specified amount of electricity. Consequently, bills in this report are typical rather than actual. They are also not inclusive since they do not capture all consumption levels and rate schedules. Since the bills include allowances for taxes, fuel adjustments, energy charges, etc., they are net bills. 5 figs., 47 tabs.

11200 (GB—166) BP statistical review of world energy. (British Petroleum Co. Ltd., London). Jun 1988. 39p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755447/JAW.

Data on the world major energy resources, oil, natural gas, coal, nuclear energy and hydroelectricity, are presented in extensive tabulations and graphically. Country by country statistics, mostly for the period 1977 to 1987, are given and trends and regional patterns are extracted. For oil, data on reserves, production, consumption, crude oil and product prices, refinery capacities and throughputs, and trade movements are listed. Data on the reserves, production and consumption of coal, and the consumption of nuclear energy and hydroelectricity are tabulated. Finally, world total primary energy consumption data is given for the period 1968-1987, illustrating a continuing climb and showing an increase in demand of 2.8% for 1987; this is for commercially graded fuels only and excludes such fuels as wood, peat and animal waste for which reliable statistics are not available. A breakdown into consumption by fuel shows a 1.4% increase in demand in the oil sector, compared with 3% for 1986, reflecting the recovery in oil prices and consequent enhanced competitiveness of other fuels. Local consumption rose by nearly 3%, nearly half of this accounted for by the centrally planned economies, and nuclear energy demand increased by more than 7% continuing a rising trend. (U.K.).

2990 Unconventional Sources And Power Generation

REFER ALSO TO CITATION(S) 10856, 10861, 11185, 11200

11201 (BEI—1980, pp 18) **Alcohol fuels for Canada.** Efford, I.E. (Energy, Mines and Resources, Canada). 1980. CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada. (CONF-8006185—; CE—02121).

From Canadian national power alcohol conference; Winnipeg, Canada (20 Jun 1980).

A discussion is presented of liquid fuels in Canada, the role of alcohol fuels within Canada's fuel supply, and federal energy policy concerns related to these fuels. The Canadian government is concerned about liquid fuels because they are in short supply. National efforts to improve this situation have concentrated on energy conservation and the substitution of non-liquid fuels in areas where liquid fuels are not essential, in addition to efforts to increase liquid fuels production. A series of fuel options are outlined, including changes in fuel formulations, upgrading of heavy hydrocarbons, and use of liquefied gases. As a fuel option, alcohol fuels have disadvantages: relatively high cost and technical problems when used in hydrocarbon fuel systems. However, alcohol fuels produced from biomass have some offsetting advantages; feedstocks would be widely available, and would be a renewable resource. These advantages suggest that a modest contribution of alcohol fuels from low-value biomass could be produced at $30-50/bbl oil equivalent. Some federal concerns about fuel alcohol production are examined: the poor energy balance in ethanol production from crops, the cost of alcohol production from biomass, and availability of feedstocks. It is concluded that ethanol produced from conventional agricultural feedstocks is not a major national energy opportunity, except possibly in areas where feestocks can be obtained at low cost or where environmental credits can be earned. In the longer term, new production processes may make large-scale ethanol production from biomass residues possible. It is also seen that more research and development is needed and appropriate government policy needs to be formulated. 4 figs., 1 tab.

11202 (BEI—1980, pp 6) **Energy supply and alcohol fuels.** Craik, D.W. (Energy and Mines, Man.). 1980. CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada. (CONF-8006185—; CE—02121).

From Canadian national power alcohol conference; Winnipeg, Canada (20 Jun 1980).

This presentation outlines some facts about the energy supply and demand situation in Canada, as a framework for subsequent discussion about Manitoba's renewable energy policies. Overall, there is a current excess in domestic oil demand over supply, and this shortage is expected to continue at least to 1995. A number of federal programs for oil substitution have therefore been implemented. In Manitoba, nearly half of the provincial energy demand is supplied by oil; in order to reduce oil dependency, provincial policy favors increased oil prices, along with proper monitoring of oil companies, to reduce demand and provide an incentive for oil substitution; market pricing for natural gas, which is in abundant supply, in order to encourage its consumption; and integration of Manitoba's hydroelectric resources with other provinces by means of a western power grid, to permit rational substitution of renewable hydro energy. In addition, a recently implemented policy encourages the use of gasohol as an automotive fuel: gasohol produced from Canadian-made alcohol by fermentation is exempt from provincial gasoline taxes. About 1.5 million gal/y of ethanol will be produced from a former beverage alcohol distillery; this would provide stock to produce a quantity of gasohol representing 4% of Manitoba's gasoline demand.

11203 (BEI—1980, pp 7) **Fuelling Canada's future.** Rowan, M. (Ontario Ministry of Energy). 1980. CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada. (CONF-8006185—; CE—02121).

From Canadian national power alcohol conference; Winnipeg, Canada (20 Jun 1980).

This discussion of Ontario fuel supply options focuses on the development of alternative fuels. A goal has been set to achieve zero net increase in per capital crude oil consumption by 1985, and to reduce the annual increase in total energy demand to 2.2%. As part of these goals, a 15-year energy from waste program has been initiated; the aim is to utilize municipal waste, sewage sludge, commercial and industrial refuse, agricultural and forest waste, and industrial by-product heat to produce 3.2% of primary energy needs. However, since about half of all petroleum products are consumed in transportation, fuel substitution policies are being concentrated in this latter area. Fuel alcohols are one of the alternatives, and some programs have been developed to investigate this option. The feasibility of farm-scale ethanol production, hybrid poplar farming for energy-related uses such as methanol production, the economics of alcohol plant location, and use of fuel alcohol in internal combustion engines are among the research projects being conducted. Incentives have also been introduced to promote alternative fuels in transportation: a variety of fuels, including alcohol, have been exempted from the provincial gasoline tax, and the sales tax has been removed from vehicles powered by alternative fuels such as propane, natural gas and fuel alcohols.

11204 **(NEI-SE—29) Solid waste management in Sweden.** (Svenska Renhallningsverks-Foereningen, Stockholm). Feb 1988. 25p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755832/JAW.

The publication is a review of all aspects of waste production and handling in Sweden. Legislation and policies concerning waste is treated, and administrative, trade and R and D institutions of interest to waste handling are listed. (L.E.).

30 DIRECT ENERGY CONVERSION

3001 Mhd Generators

REFER ALSO TO CITATION(S) 11439, 11589

11205 **(BARC—1391) Seeded inert gas driven disk generator.** Joshi, N.K.; Venkatramani, N.; Rohatgi, V.K. (Bhabha Atomic Research Centre, Bombay (India). Plasma Physics Section). (Bhabha Atomic Research Centre, Bombay (India)). 1987. 42p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704083/JAW.

This report outlines the present status of work being carried out in closed cycle MHD and disk generators. It gives the basic principles and discusses a proposal for setting up an experimental facility to study nonequilibrium plasmas using an inert gas driven disk generator. Disk geometry is a near ideal geometry for plasma studies since it has single or few pair electrodes combined with near perfect insulating walls. The proposed outlay of facility with components and subsystem is given. The facility may also be used to study the concept of fully ionized seed and to develop advanced diagnostic techniques. The absic equation describing the working parameters of such a system is also given in the Appendix. (author). 57 refs.

11206 **(DOE/ET/15601—T47) Diagnostic development and support of MHD test facilities: Technical progress report, January--March 1987.** (Mississippi State Univ., Mississippi State (USA). MHD Energy Center). Apr 1987. Contract AC02-80ET15601. 34p. (FE—15601-28). NTIS, PC A03/MF A01 - OSTI. Order Number DE89003536/JAW.

Mississippi State University is developing diagnostic instruments for MHD power train data acquisition and for support of MHD component development test facilities. Microprocessor-controlled optical instruments, initially developed for HRSR support, are being refined, and new systems to measure temperatures and gas-seed-slag stream characteristics are being developed. To further data acquisition and analysis capabilities, the diagnostic systems are being interfaced with MHD Energy Center computers. Additionally, technical support of the diagnostic needs of the national MHD research effort is being provided. 9 figs., 1 tab.

11207 **(DOE/ID/01745—T19) MSE, Inc., quarterly technical progress report, July 1--September 30, 1988.** (MSE, Inc., Butte, MT (USA)). 1988. Contract AC07-78ID01745. 11p. NTIS, PC A03/MF A01. Order Number DE89003515/JAW.

This quarterly technical progress report presents the tasks accomplished at the Component Development and Integration Facility during the fourth quarter of FY88. Areas of technical progress this quarter included: coal system development; seed system development; test bay modification; channel power dissipation and distribution system development; split coal feed system; coal-fired precombustor; continuing checkout of iron core magnet thermal protection system; combustion carbon balance and stack gas analysis; coal-fired combustor support; 1A channel refurbishment; arc observation project; dry materials transfer system controls upgrade; test operations and results; data enhancement; technical papers; and projected activities. 1 tab.

11208 **(DOE/PC/79678—T1) An innovative demonstration of high power density in a compact MHD generator: Semi-annual report.** Lineberry, J.T.; Schmidt, H.J.; Chapman, J.N. (Tennessee Univ., Tullahoma (USA). Space Inst.). May 1988. Contract AC22-87PC79678. 104p. NTIS, PC A06/MF A01 - OSTI; 1; GPO Dep. Order Number DE89002159/JAW.

This document is the first semi-annual report for this project. It has been prepared in accordance with contractual reporting obligations and contains a written summary of the research work which has been performed since the beginning of the project through March 31, 1988. During this period, research work has included a variety of studies on several aspects of the overall project as was needed to scope out the requirements for proceeding with a detailed design of experimental hardware. One of the major objectives of these efforts was to provide a definition of operating conditions that are required to allow this MHD system to meet the program objectives. These background studies encompassed detailed analyses of the combustion of the aluminum/carbon (Al:C) solid fuel and evaluations of the gas dynamic characteristics of the combustion plasma produced by combustion. Another major effort was that of analyses and predictions of the performance of conceptual designs for the MHD generator. Both of these tasks were directed at obtaining necessary information which would allow geometric scaling of the experimental MHD system. A summary of the design studies that were performed is given within the body of this report. 5 refs., 62 figs., 3 tabs.

3005 Fuel Cells

REFER ALSO TO CITATION(S) 11007, 11150

11209 **(DOE/NASA—0017-7) Assessment and comparison of 100-MW coal gasification phosphoric acid fuel cell power plants.** Lu, Cheng-Yi. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center; Cleveland State Univ., OH (USA). Dept. of Chemical Engineering). Aug 1988. Contract AI21-80ET17088. 9p. (NASA-CR—182189; CONF-881010—5). NTIS, PC A02/MF A01 - OSTI. Order Number TI89003419/JAW.

From 11. fuel cell seminar: development and application of fuel cells for the 90's; Long Beach, CA, USA (23 Oct 1988).

One of the advantages of fuel cell (FC) power plant is fuel versatility. With changes only in the fuel processor, the power plant will be able to accept a variety of fuels. This study was performed to design process diagrams, evaluate performance, and to estimate cost of 100 MW coal gasifier (CG)/phosphoric acid fuel cell (PAFC) power plant systems that would use coal, which is the largest single potential source of alternate hydrocarbon liquids and gases in the United States, as the fuel. Results of this study will identify the most promising integrated CG/PAFC design and its near-optimal operating conditions. The comparison is based on the performance and cost of electricity (COE) which is calculated under consistent financial assumptions. 2 refs., 2 tabs.

11210 **(LBL—26115) Methane oxidation with proton conducting ceramic electrolytes.** Visco, S.J.; Ross, P.H.; De Jonghe, L.C. (Lawrence Berkeley Lab., CA (USA)). Oct 1988. Contract AC03-76SF00098. 5p. (CONF-8810259—1). NTIS, PC A02/MF A01 - OSTI. Order Number DE89004698/JAW.

From Inorganic chemistry review meeting; Chicago, IL, USA (26 Oct 1988).

11211 **(N—89-10405) Hydrogen-bromine fuel cell advance component development.** Charleston, J.; Reed, J. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). 1988. 16p. (NASA-TM—101345; E—4368; NAS—1.15:101345; CONF-8807144—). NTIS, PC A03/MF A01.

From National Technical Association conference; Chicago, IL, USA (13 Jul 1988).

Advanced cell component development is performed by NASA Lewis to achieve improved performance and longer life for

the hydrogen-bromine fuel cells system. The state-of-the-art hydrogen-bromine system utilizes the solid polymer electrolyte (SPE) technology, similar to the SPE technology developed for the hydrogen-oxygen fuel cell system. These studies are directed at exploring the potential for this system by assessing and evaluating various types of materials for cell parts and electrode materials for bromine-hydrogen bromide environment and fabricating experimental membrane/electrode-catalysts by chemical deposition.

11212 **Advanced fuel cell systems for transportation applications.** Vanderborgh, N.E.; Spirio, C.A.; Huff, J.R. (Los Alamos National Lab., NM (USA)). pp 253-261 of Fuel cell technology and applications. Utrecht, Netherlands; Management Office for Energy Research PEO (1987). (CONF-8710316—).

From Fuel cell seminar; Hague, Netherlands (26 Oct 1987).

Progress in methanol-powered fuel cell systems for electric vehicle propulsion is reviewed, and fuel processing and fuel cell developments are described. 4 figs., 11 refs.

11213 **An overview of the Westinghouse Electric Corporation solid oxide fuel cell program.** Dollard, W.J.; Parker, W.G. (Westinghouse Electric Corp., Pittsburgh, PA (USA)). pp 262-273 of Fuel cell technology and applications. Utrecht, Netherlands; Management Office for Energy Research PEO (1987). (CONF-8710316—).

From Fuel cell seminar; Hague, Netherlands (26 Oct 1987).

An overview is presented of the Westinghouse solid oxide fuel cell program including the status of the technology and the plans for commercialization during the 1990's. 7 figs.

11214 **Effects of soot and contaminants on coal-gas fueled MCFC.** Pigeaud, A.; Klinger, J.; Maru, H. (Energy Research Corp., Danbury, CT (USA)). pp 309-318 of Fuel cell technology and applications. Utrecht, Netherlands; Management Office for Energy Research PEO (1987). (CONF-8710316—).

From Fuel cell seminar; Hague, Netherlands (26 Oct 1987).

The results of a study of the effects of coal-gas derived impurities on the performance and endurance of the molten carbonate fuel cell (MCFC) are reported. Soot formation boundaries for dry and carbonate-wetted surfaces were determined and verified in atmospheric and pressurized cells. Tolerance limits for particulates, ammonia, arsenic, lead, mercury, hydrocarbons and zinc vapor have also been defined on the basis of thermogravimetric measurements and cell tests. 2 figs., 14 refs., 4 tabs.

32 ENERGY CONSERVATION, CONSUMPTION, AND UTILIZATION

REFER ALSO TO CITATION(S) 11579

11215 **(FRNC-TH—3243) Simulation and optimization of micro-energetic systems.** Valette, F. (Institut National des Sciences Appliquees (INSA), 31 - Toulouse (France)). 1986. 321p. (In French). NTIS (US Sales Only), PC A14/MF A01. Order Number DE88756322/JAW.

Sosi I model dealing with energetic systems in which several conventional or renewable resources are confronted with multiple demands (electricity, heating, fuels), is presented. Optimization of structure and combination of collectors, energy conversion and energy storage systems for energy management is studied, with an application to fictitious cases in buildings and two real cases (farming and laboratories). Research into the future evolution of the development of thermal solar equipment in France are presented.

11216 **(NEI-FI—53) Economical optimization and control of energy management in a geographically dispersed industrial company.** Alahuhta, T.; Ijaes, M.; Leppaenen, S. (Enso Gutzeit Oy, Imatra (Finland)). (Kauppa-ja Teollisuusministerio, Helsinki (Finland). Energiaosasto). Dec 1987. 79p. (In Finnish). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88755814/JAW.

The purpose of this study was to explain questions and their computerized solutions concerning economical optimization and control of energy management in a geographically dispersed industrial company. The main questions were predicting the needs of energy, creating the models of factories and power plants, and simulation and optimization methods based on the predictions and the plant models. Also there is the need of communication network between units far apart each other. The communication network must be highly dependable and reasonably priced. Other requirements are expandability, adaptability for future technical alterations and expert services of the company managing the communications. Afora Oy, in co-operation with KTM, the Finnish Ministery of Commerce and Industry, carried out a parallel study of the realization of the plant models and the company models /sup K/onsernitason energianhankinnan simulointiympaeristoen luomminen/sup ./ In both this and the Afora study the conclusions were the same. It is possible to carry out the simulations and the optimizations of both the plantlevel and the company level as an off-line routine and acchieve good results in the economical control of the utilization of energy. The company has decided to build a computerized central control plant for controlling energy utilization. The cost of this plant is about 8 million FIM. The pay-back time of the investment is estimated to be 1.4 years.

3201 Buildings

REFER ALSO TO CITATION(S) 10936, 10938, 11157, 11281, 11291, 11292, 11441, 11584, 11597, 11719, 11775

11217 **(AFME—85-91-1003-3) Shading effect of environment.** Bourdeau, L. (Agence Francaise pour la Maitrise de l'Energie, 75 - Paris). Nov 1986. 72p. (In French). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88756326/JAW.

This study deals with the influence of the physical environment on the incident solar radiation on the walls of buildings. It has aimed to provide urbanists and designers with the tools needful for the evaluation of this influence as much at the level of layout plan as at the level of development plan. The tools which have been developed are: manual simplified tools based on a schematic representation of the obstacles of the environment with fictitious screens, and on a simplification of the calculation process properly so called; software tools allowing either to establish radiation maps taking account of ground relief and buildings either to carry out an automate calculation of the influence of the obstacles in various points of a layout plan or facades of buildings.

11218 **(BFR-R—64-1988) Heat pumps in experimental building installations in Sweden. BFR's overall evaluation.** Baeckstroem, B.; Hallen, T. (Energiprojekt T.H. AB, Goeteborg (SE)). (Statens Raad foer Byggnadsforskning, Stockholm (Sweden)). 1988. 41p. (In Swedish). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755754/JAW.

Data collection and evaluation of 50 installations was made with the objective to provide a basis for comparison of different projects as regards technology, economy, reliability in operation, etc. The installations discussed represent a total investment of c. 200 MSEK and an equivalent oil saving of c. 50 000 m/sup 3// year. Classification with regard to heat source with number of installations: exterior air 9, surface ground 7, exhaust air 3, aquifer/mine 4, rock/deep ground 3, waste water 5, ice-rinks 2, surface water 8, ground water 6, others 3. (O.S.).

11219 **(BFR-R—65-1988) Design rating of lake source heat collectors.** Svensson, T.; Soerman, L.O. (Chalmers Univ. of Tech., Goeteborg (Sweden). Dept. of Hydraulics). (Statens Raad foer Byggnadsforskning, Stockholm (Sweden)). 1988. 90p. (In Swedish). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88755755/JAW.

Technology and bases for using lakes and watercources as heat source for heat pumps has been studied at Chalmers Technical University for 10 years. Earlier laboratory measurements has been performed of heat transfer to flexible tubes in different environments, simulating lakes and watercourses in winter. In the present project a computer model based on the laboratory results has been developed for calculation of heat absorption and ice formation

along heat absorbing tubes for stationary conditions. The model is suited for use by dimensioning of collectors going out from information of temperature and flow conditions, and tube location in the water. Also the thermal properties of the tube and the brine must be known. The main result of the project is the calculation program SJOEKOLL. As an aid in practical dimensioning a few type cases are presented in diagrammatic form. (O.S.).

11220 **(BFR-R—66-1988) Controlled natural ventilation with heat recovery. Evaluation of an experimental building project.** Hecktor, B.O.; Raemner, G. (K-Konsult, Kalmar (SE)). (Statens Raad foer Byggnadsforskning, Stockholm (Sweden)). 1988. 65p. (In Swedish). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88755756/JAW.

The system is principally of natural ventilation design adapted to reconstruction measures of older multiple-unit dwellings with complementary supply air control and exhaust air control. The advantages of free convection are maintained and its drawbacks, like back-draught and over the year strongly fluctuating air flow, are eliminated. The basic equipment also comprises heat exchangers that could be connected to a heat pump for exhaust air heat recovery. The complete system including a heat pump was installed in a unit of three buildings containing 50 apartments with a common heating system. Results of and conclusions of a one year test period are presented. (O.S.).

11221 **(BFR-R—72-1988) Heat from a sandstone aquifer. Performance monitoring of a two-well system.** Holm, T.; Nilsson, P.; Wilen, P. (Chalmers Inst. of Tech., Goeteborg (SE). Geology). (Statens Raad foer Byggnadsforskning, Stockholm (Sweden)). 1988. 48p. (In Swedish). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755758/JAW.

The installation supplies a service house in Falkoeping. The ground water used is taken from a sandstone aquifer. Heat pump functioning and performance is evaluated. The sandstone aquifer as a heat source is investigated. The heat pump installation coverage has been 87.4%. Coefficient of performance on a year basis was 2.05. Water temperature decreased from 7.8 to 5.5 degrees C and will in further three years decrease to 4.5 degrees C. Water flow goes mainly via fractural zones. Energy price of the heat pump system is SEK 0.29 per kWh, which is competitive with electric heating and oil firing. 4.5% of the energy requirement is covered by renewable energy. (O.S.).

11222 **(CONF-890105—3) Blower-door-directed infiltration reduction procedure description and field test.** Gettings, M.B. (Oak Ridge National Lab., TN (USA)). 15 Sep 1988. Contract AC05-84OR21400. 19p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89002312/JAW.

From ASHRAE winter symposium; Chicago, IL, USA (28 Jan 1989).

Infiltration reduction has long played a major role in the weatherization of residential buildings. In many weatherization programs, standard procedures include the automatic caulking and weatherstripping of doors and windows, possibly leaving other major leakage sites, such as attic bypasses and electrical outlets, unattended. Frequently, no quantitative measures of the success of the infiltration retrofits is available. Several studies have indicated that implementation of infiltration retrofits are often less effective than expected. One study indicated that 35% of a state's low income energy assistance program funds went to infiltration retrofits. Yet, many of the homes still had major infiltration problems. A second study showed that 50 low income homes showed no significant leakage rate reductions after retrofits which included air infiltration control. 13 refs., 1 fig., 3 tabs.

11223 **(CONF-890105—4) Selection of ozone-safe, nonazeotropic refrigerant mixtures for capacity modulation in residential heat pumps.** Vineyard, E.A.; Sand, J.R.; Statt, T.G. (Oak Ridge National Lab., TN (USA)). 1989. Contract AC05-84OR21400. 27p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89003153/JAW.

From ASHRAE winter symposium; Chicago, IL, USA (28 Jan 1989).

Many combinations of refrigerants have been tested in an effort to improve the efficiency of residential heat pumps. Up to this point, there has been no systematic approach for determining which fluid pairs have the greatest potential for improving heat pump performance. The primary purpose of this work was to perform a comprehensive screening of refrigerant pairs which, through a shift in composition, could improve the performance of heat pump systems by modulating their capacity to better follow a building load. Secondary goals were to select a mixture with (1) a gliding temperature difference that matches that of the heat transfer fluid in both heat exchangers and (2) a higher capacity relative to R22 at low outdoor temperatures. The number of pure components was pared on the basis of boiling point, stability, ozone depletion potential, and toxicity. Pairs were then assembled from the pure components using the temperature glide (the constant-pressure temperature change that the fluid undergoes in the two-phase region as it passes through the heat exchanger) and the coefficient of performance to determine those pairs with the highest potential. The conclusions were that mixtures of R32/R124, R32/R142b, R143a/R124, R143a/R142b, and R143a/C318 were the best candidates for accomplishing the project goals. Although the mixtures were tailored for residential heat pumps with an emphasis on capacity modulation, the screening process could be used for other refrigeration applications as well. 11 refs., 4 figs., 2 tabs.

11224 **(DOE/CE/23838—T3) Energy conservation in buildings, 1986--1987: Department of Energy research summary report, 1986--1987.** Harrje, D.T. (Princeton Univ., NJ (USA). Center for Energy and Environmental Studies). Nov 1987. Contract FG01-86CE23838. 27p. (PU/CEES—219). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004672/JAW.

Under the headings of Overview, Building Science and Retrofit Field Studies, this report summarizes the research accomplished with US Department of Energy support under Grant DE-G01-86CE23838 covering the period July 1986--April 1987. Details of the complete findings, as a result of this contract research, may be found by consulting the appropriate reports and technical papers listed under References. Many aspects of the research were actively assisted by outside collaboration as well as interaction with other DOE laboratories. Such activities are listed under Collaboration. The research generally falls into two categories: Building Science and Retrofit Field Studies. 19 refs., 5 figs., 2 tabs.

11225 **(DOE/ER/60661—1) [Analysis of DNA damage and mutations induced by radon daughter products]: Progress report.** Schwartz, J.L. (Chicago Univ., IL (USA)). 1988. Contract FG02-88ER60661. 11p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004860/JAW.

The goal of the project is to better understand the genetic and somatic risks associated associated with radon exposure by characterizing both the DNA lesions induced by radon and the mechanisms by which both these lesions are processed. In order to accomplish this goal, we are exposing mammalian cells in vitro to the radon daughter product ^{212}Bi and analyzing DNA damage at the cellular, cytogenetic and molecular level. In addition, we are examining the influence of DNA repair systems on ^{212}Bi-induced cytotoxicity, DNA/chromosome breakage and gene mutations. The experiments to date have involved treatment of four different Chinese hamster ovary (CHO) cell lines with ^{212}Bi and x rays to measure: (1) DNA and chromosome break induction, (2) cell killing, and (3) mutation induction at the HGPRT locus. The four CHO cell lines include AA8, EM9, CHO-K1 and XRS-5. They differ in radiosensitivity and in their ability to rejoin DNA single- and double-strand breaks. EM9 is deficient in its ability to rejoin DNA single-strand breaks and XRS-5 is deficient in its ability to rejoin DNA double-strand breaks. 2 figs., 2 tabs.

11226 **(EGG-EP—7791) Heat-of-reaction chemical heat pumps.** Kiroi, L.; Bliem, C. (EG and G Idaho, Inc., Idaho Falls (USA)). Apr 1988. Contract AC07-76ID01570. 120p. NTIS, PC A06/MF A01 - OSTI. Order Number DE89004840/JAW.

Chemical heat pumps are mechanically driven heat pumps with working fluids that undergo chemical changes or are heat-driven heat pumps in which either the driver (heat engine) or heat pump utilizes a reactive working fluid. As such, chemical heat

pumps can be classified by drive (electric drive, heat amplifier, or temperature amplifier), operating mode (periodic or continuous), coupling between the heat engine and heat pumps, thermodynamic cycle used in the heat engine and heat pump, and phases of the working material. This classification of chemical heat pumps suggests many new heat pump configurations that have not been considered previously. This document describes possible heat pump configurations and the justification for selecting certain heat pumps for further study. Four types of heat-of-reaction chemical heat pumps are considered worthy of further development; the characteristics of these pumps are discussed in this document. 18 refs., 19 figs., 2 tabs.

11227 **(IREQ—7803) Research and development on extended range water source heat pumps.** Critchlow, P.R.; Langhame, Y. (Institut de Recherche d'Hydro-Quebec, Varennes (Canada)). 1978. 75p. (CE—02216). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

This report reviews the possible technical constraints relative to the usefulness of natural water source heat pump systems in Canada. Of the available sources, only ground water has a significant potential. Four attractive sites, having ample pure warm water, are identified. Rivers and lakes are judged too cold and relatively inaccessible. In order to have a high overall system efficiency it is recommended that losses should be minimised and an intelligent choice made for the type of heating used. Even though many losses appear as heat, they reduce the total efficiency. Systems using low temperature circulating fluids are preferred. The global coefficient of performance (COP) is estimated to be 3-3.5. The number of controls should be kept to a minimum without compromising security. Whenever practical, an infiltration basin is the simplest and cheapest method of water disposal. It can, however, only be effective in sandy or gravel-like ground. In clay or rocky conditions a second well will probably be required. In rare cases storm sewers, a river, or lake might be conveniently used. Corrosion resistant materials should be selected if the quality of water is doubtful. If further precautions are necessary, standard water treatment practice is recommended. Stops and starts should be kept to a minimum because of the low COP during start-up. Several techniques to accomplish this are suggested. A list of possible environmental effects is given. With care, none of these should create a serious constraint to water source heat pump systems. A sample calculation for a typical single-family dwelling in Quebec indicates that for a house with a peak heating load of 8 kW a heat pump system with COP=3, the required flow of water (ΔT = 6/sup 0/C), is about 0.22 l/s. The cost of a system might be about $6,000. Includes annotated bibliography. 51 refs., 8 figs., 3 tabs.

11228 **(LUTVDG/TVBH—1004-1-216-1988) Heat loss to the ground from a building. Slab on the ground and cellar.** Hagentoft, C.E. (Lund Inst. of Tech. (Sweden). Dept. of Building Technology). Apr 1988. 220p. NTIS (US Sales Only), PC A10/MF A01. Order Number DE88755782/JAW.

Heated buildings induce a heat flow from the building foundation into the ground. The topic of this thesis is the thermal process in the ground and, in particular, the heat losses from the building to the ground. Foundations of the three types slab on the ground, cellar, and crawl-space are dealt with. The crawl-space is treated in a separate report. A reasonably complete theory for the thermal processes, and in particular the heat loss, is expounded. Dimensionless formulation, superposition technique, and analytical solutions for basic periodic and step-response components are used. The three-dimensional, steady-state heat loss component is obtained from numerical solutions. An accurate and manageable calculation method for heat losses to the ground has been developed. The method, which is based on both numerical calculations and analytical solutions, accounts for three-dimensional effects and the time-varying outdoor temperature in a proper way.

11229 **(NEI-FI—51) Evaluation of building energy research projects, Report no 1.** Ripati, H. (Climaconsult Oy, Espoo (Finland)). (Kauppa-ja Teollisuusministerio, Helsinki (Finland). Energiaosasto). Dec 1987. 49p. (In Finnish). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755812/JAW.

The aim of this project was to evaluate the energy research work, which has been carried out in the field of building energy conservation during the last ten years. The other aim was to pick up the usable bits of information from the reports and convert them into a form which is easy for design engineers to use. About half (99 pcs) of the total 202 R and D projects was evaluated. The other half (103) of the projects was evaluated in the previous phase of the work during 1986. Evaluation work was only based on the research reports written by researches of each project. More than 260 bits of usable information were found from 62 reports during the evaluation. These bits were reformed to illustrate new energy technology in an informative and feasible way. These bits of information will be published and delivered to architects and building design engineers first in printed form. Later on these will be loaded into a microcomputer based databank in order to be better utilized.

11230 **(NEI-FI—54) Renovation of office building.** Tapiola, M.; Laaksonen, A.; Heinaenen, S.; Koivula, U.; Mattila, J. (Air-Ix Oy, Helsinki (Finland)). (Kauppa-ja Teollisuusministerio, Helsinki (Finland). Energiaosasto). 1987. 81p. (In Finnish). NTIS (US Sales Only), PC A05. Order Number DE88755815/JAW.

The design and success of renovation construction depends on a precise building condition estimation. A methodical system that supplies an exact condition estimation of the building prior to renovation should be developed. At present, designers lack thorough knowledg of building physics, especially in the areas of heat, moisture and sound insulation. Fire safety regulations also cause design and construction problems. In the field there seems to be a lack of research and practical feedback knowledge. The study was carried out in 1983 on a renovated office building called Air-Ix Talo in Tampere. The renovation consisted mainly of window constructions, HVAC, piping and electrical installations. The energy ecouctions, HVAC, piping and electrical installations. The energy economics of the building was studied. The total specific energy consumption was 60 kWh/m/sup 3/ a, which is 15% below the average value third of the total energy need. The indoor air flow supplied at a rate of 18 dm/sup 3//s per person. It was found that at a rate of 10 dm/sup 3//s per person the indoor air became fouled with carbondioxide concentrations exceeding 1100 cm/sup 3//m/sup 3/. However, at any rate of outdoor air flow, the particle concentration was found to be below outdoor air levels due to circulation air filters. The mixing ventilation installation consisted of constant air flow devices. At full air flow the air exchange effectiveness did not reach complete mixing. When operating at half power the supply air flow short circuted. This resulted in a reduction of the air exchange effectiveness by between 10 to 20 percent under the value of complete mixing.

11231 **(NEI-FI—56) Approaches to real estate management and energy consumption in housing companies.** Melasniemi-Uutela, H. (Central Statistical Office, Helsinki (Finland)). (Kauppa-ja Teollisuusministerio, Helsinki (Finland). Energiaosasto). Jun 1988. 113p. (In Finnish). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88755817/JAW.

The aim of the survey was to study how the approaches to management and maintenance of housing companies correlated with the level of heating energy consumption of buildings and with the frequency of concrete action taken to save energy. The population consisted of 1.269 housing companies in different parts of Finland. They represented blocks of flats and attached houses served by district heating systems. The data were solicited by postal inquiry from building managers or were obtained from registers. The survey concerned the year 1984.

11232 **(NEI-FI—57) Research for Experimental Determination of Heat Losses in District Heating Elements.** Huovilainen, R.; Roiha, I. (Lappeenrannan Teknillinen Korkeakoulu (Finland). Energiatekniikan Laitos). Dec 1987. 75p. (In Finnish). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88755818/JAW.

The object of the research was to explain the dependence of the heat losses on various factors under normal conditions in different types of modern district heating lines. For this purpose six test lines with different element types, all with a length of 60 m and nominal diameter of ND 100, were installed in the same sort of earth in Kapteeninkatu in the city of Lappeenranta, Finland. The heat losses of each test line were measured between April 1984 and April 1986. On the basis of the measuring results the real heat losses and the calculated thermal conductivities of the insulations were determined for each line.

11233 **(NEI-FI—61) Use of lights.** Koski, P. (Ekono, Helsinki (Finland)). Dec 1987. 94p. (In Finnish). NTIS (US Sales Only), PC A05. Order Number DE88755822/JAW.

Lights are often used needlessly in different spaces of buildings, for instance in unoccupied hours. This occurs in all kinds of buildings. The study describes the use of office lighting and occupancy during working days every half an hour in five different buildings. Data on more than 700 roomdays was received. It was, for example, found out that of all observations in lighted offices about 39% told the room to be unoccupied. Only 28% of those observations, telling about the needless use of lighting, were occasional. So it is possible that office rooms are unoccupied longer periods at a time. If generalizing the observation results it is clear that in offices the needless use of lights discussed above represents an energy consumption of about 150 GWh/a and a maximum power of about 85 MW in the middle of the day. Burning hours of lamps were also measured in different rooms in the study. For instance the burning hours of lamps were on the average 1240 h/a in one-person office rooms. In schools, classroom lighting was on about 960 h/a and in hospitals, lighting in bedrooms was on about 2300 h/a on the average. In warehouses lights were on about 12.8 h/d on working days and 9.6 h/d on Saturdays. Many new and sophisticated lighting control systems have been developed. Their flexibility can often be considered as the main benefit of them. A simple and unfailing control system taking advantage of daylight in different areas of public and service buildings would be required. Trial installations and example solutions could probably best help development of new control systems and make them more common.

11234 **(NP—9770208) Klausdorf model plan. Further developments of the energy-saving housing concept 'Erohnhof-Plan' with special consideration of the passive use of solar energy. Final report of planning phase.** Morovic, T.; Pilhar, R. (Fraunhofer-Gesellschaft zur Foerderung der Angewandten Forschung e.V., Karlsruhe (Germany, F.R.). Inst. fuer Systemtechnik und Innovationsforschung; Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Aug 1987. 74p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE89770208/JAW.

An energy-saving housing concept developed in 1975 was to be applied to 50 individual new houses about to be built. In the project's detailed planning the passive use of solar energy through structural measures was to be encouraged. Planning results form the sectors of urban development, landscape planning and technical construction were coordinated. A detailed report is given on the framework for the introduction of the model plan, the pre-planning and coordination in the various areas of planning, the final draft planning for buildings (types of houses) and landscape (private gardens, urban footpaths) and on planning for heat supply (heating, warm water). The general endeavours were directed towards an improvement of surface usage, the matching of the housing group to the topography and the equipment of the buildings for an optimal use of solar energy. (HWJ).

11235 **(ORF/ES—8512) A study of energy savings using low-flow showerheads. A research report.** (Ontario Research Foundation, Mississauga (Canada). Engineering Sciences Div.). 1985. 49p. (CE—02184). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

This report outlines the findings of a staged project to investigate the cost savings potential and user acceptability of low-flow showerheads. The report is divided into sections outlining availability, laboratory evaluation, field performance, subjective evaluation, and economics of low-flow showerheads. The study demonstrates that some low-flow showerheads perform in an acceptable fashion, according to a subjective evaluation panel. Factors which tended to promote user acceptability included wide spray diversion, medium spray size and moderate to high water pressure. Showerheads which did not perform in accordance with these criteria were downrated by the user panel. Half of the tested showerheads were disliked moderately to slightly, according to the panel. Problems with vandalism were encountered when the showerheads were installed in a Toronto health club, severely limiting the usefulness of the field data. The economics of the low-flow showerheads appear attractive. Cost savings of up to $35 per year are possible for single family residences, with lesser potential savings for other building types. It should be noted, however, that for applications such as health facilities, where the predicted savings are on a per user basis, savings would be multiplied by the number of users per shower. 10 refs., 1 fig., 20 tabs.

11236 **(ORNL—6520) Decision guide for roof slope selection.** Sharp, T.R.; Wendt, R.L.; McCorkle, J.E. (Oak Ridge National Lab., TN (USA)). Oct 1988. Contract AC05-84OR21400. 77p. NTIS, PC A05/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005706/JAW.

This decision guide has been written for personnel who are responsible for the design, construction, and replacement of Air Force roofs. It provides the necessary information and analytical tools for making prudent and cost-effective decisions regarding the amount of slope to provide in various roofing situations. Because the expertise and experience of the decision makers will vary, the guide contains both basic slope-related concepts as well as more sophisticated technical data. This breadth of information enables the less experienced user to develop an understanding of roof slope issues before applying the more sophisticated analytical tools, while the experienced user can proceed directly to the technical sections. Although much of this guide is devoted to the analysis of costs, it is not a cost-estimating document. It does, however, provide the reader with the relative costs of a variety of roof slope options; and it shows how to determine the relative cost-effectiveness of different options. The selection of the proper roof slope coupled with good roof design, a quality installation, periodic inspection, and appropriate maintenance and repair will achieve the Air Force's objective of obtaining the best possible roofing value for its buildings. 21 refs., 17 figs., 10 tabs.

11237 **(ORNL/CON—261) Electricity displacement by wood used for space heating in PNWRES [Pacific Northwest Residential Energy Survey] (1983) households.** White, D.L.; Tonn, B.E. (Oak Ridge National Lab., TN (USA)). Dec 1988. Contract AC05-84OR21400. 35p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005708/JAW.

This report evaluates the amount of electricity for residential space heating displaced by the use of wood in a sample of single-family households that completed the 1983 Pacific Northwest Residential Energy Survey. Using electricity bills and daily weather data from the period of July 1981 to July 1982, it was determined that the average household used 21,800 kWh per year, normalized with respect to weather. If no households had used any wood, electricity use would have increased 9%, to 23,700 kWh; space heating electricity use would also have increased, by 21%, to 47% of total electricity use. In the unlikely event that all households had used a great deal of wood for space heating, electricity use could have dropped by 23.5% from the average use, to 16,700 kWh; space heating electricity use would have dropped by 56%, to 24% of

total electricity use. Indications concerning future trends regarding the displacement of electricity by wood use are mixed. On one hand, continuing to weatherize homes in the Pacific Northwest may result in less wood use as households find using electricity more economical. On the other hand, historical trends in replacement decisions regarding old space heating systems show a decided preference for wood. 11 refs., 6 figs., 8 tabs.

11238 **(ORNL/Sub—85-53142/1) A combustion system seasonal efficiency meter: A preliminary assessment of a laboratory model.** Pearman, N. (Oak Ridge National Lab., TN (USA); Honeywell, Inc., Golden Valley, MN (USA). Technology Strategy Center). Sep 1987. Contract AC05-84OR21400. 88p. NTIS, PC A05/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005680/JAW.

The objective of this project is to build a laboratory model of a combustion system seasonal efficiency meter (CSSEM) that is portable, easy to use and can determine both steady-state and seasonal efficiency of boilers and furnaces. The meter is microprocessor-based, receiving inputs from sensors connected to the combustion system under test and from keyboard entry data describing the system. Tests in the laboratory on a natural-gas-fired, forced-warm-air furnace indicated good agreement with the DOE-AFUE (Annual Fuel Utilization Efficiency) test procedure. 7 figs., 4 refs.

11239 **(ORNL/Sub—86-04923/1) Feasibility study for collecting site soil characterization thermal property data for residential construction.** Salomone, L.R. (Oak Ridge National Lab., TN (USA); STS Consultants Ltd., Fairfax, VA (USA)). Oct 1988. Contract AC05-84OR21400. 113p. NTIS, PC A06/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005681/JAW.

According to the theory of heat transfer by conduction, soil thermal conductivity or its reciprocal, thermal resistivity, is the primary variable that influences heat loss or gain from earth contact surfaces such as uninsulated basement walls, ground-coupled water source heat pumps and underground electric cables. The thermal conductivity of soil, however, varies widely depending upon soil texture, density, and above all moisture content. The thermal conductivity of soils can vary in time and space because of changes in moisture content, density and/or soil type. Also, heat flux densities in the soil can provide the driving mechanism for moisture migration and consequent changes in soil moisture. Despite the influence of the above factors on the thermal conductivity of soils, the majority of existing computer models of the energy exchange between earth contact structures and the surrounding soil do not account for variations in soil thermal conductivity. Of the 26 experimental data sets on foundation energy losses and earth contact heat transfer found in the literature, only five of the data sets provide a description of soil and only 2 of the 26 data sets state that the thermal conductivity of the soil was measured. This report discusses the feasibility of collecting thermal property data for use in determining foundation insulation requirements in residential construction. This feasibility study assesses the availability of equipment and a judgment on facility needs. Finally, implementation procedures are recommended. 41 refs., 15 figs., 12 tabs.

11240 **(PB—89-116594/XAB) Integrating analytical tactics into New York State's weatherization assistance program: project findings. Final report.** (Synertech Systems Corp., Syracuse, NY (USA)). Sep 1987. 303p. NTIS, PC A14/MF A01.

Crews from four agencies underwent extensive three-day training sessions to become familiar with analytical tactics that combine the best features of energy-conservation strategies in combination with instrument-aided analysis and correction of air leakage. The principal tool employed during these sessions was the blower door. The blower-door seals around the door frame and uses a fan to blow colored smoke into a room to see where leaks are occurring. The leaks are then sealed. The crews were given a Technical Assistance Notebook and an auditors tool kit, both developed through this project. The agency crews employed their new skills on 25 homes in each of the four counties. Each home was given an elapsed time meter that measured energy use before and after the weatherization measures were installed. The analytical tactics provided substantial energy savings over conventional weatherization procedures, saving the homeowner money and making the weatherization program more effective. The Energy Authority and the Department of State will share the information gained from the project with all 96 weatherization agencies.

11241 **(PB—89-126619/XAB) Analysis of work-environment data from three army field stations.** Collins, B.L.; Rubin, A.I. (National Inst. of Standards and Technology (NEL), Gaithersburg, MD (USA). Center for Building Technology). Oct 1988. 177p. (NISTIR—88/3871). NTIS, PC A09/MF A01.

Data from a detailed evaluation of environment conditions in three U.S. Army field stations are presented. Three field stations were evaluated: Kunia, Augsburg, and Berlin. Results from a questionnaire administered to over 600 people at all sites in three job types (operator, analyst, and administrative/other) are given which indicate major concerns with conditions such as temperature, lighting, space, furniture, equipment functioning, and general environmental quality. Physical data obtained from measurements of over 270 work stations indicated the presence of cold temperatures, low light levels, reduced VDT screen contrast, glare, and distracting noises. The report provides the basic data that support the concerns expressed by Headquarters; namely, that field-station personnel perform their jobs under conditions likely to impair their effectiveness. Suggestions for improving conditions are given in a companion report by Rubin and Collins.

11242 **(STF—11A88024) Practical experiences from a ground water source heat pump in a central heating plant at Maalselv.** Eggen, G.; Jonassen, O. (Selskapet for Industriell og Teknisk Forskning, Trondheim (Norway)). May 1988. 16p. (In Norwegian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755890/JAW.

The report presents practical experiences from a groundwater source heat pump in a central heating plant at Maalselv in the county of Troms (Norway). The heat pump plant was put into operation in 1985, and it was the single heating source for a number of six semi-detached houses in the course of the measuring period from 1986 to 1987. The ground water temperatures varied between 3.7 and 4.3 deg Celsius, and the coefficient of performance was measured to be 3.7. The under-floor heating system described in this report seems to be cost beneficial in relation to panel heaters when the kWh rate tariff is NOK 0.40-0.45. 7 figures, 2 tables.

11243 **(STU—83-5206) Generic computer code for simulation of sorption heat pumps.** Jernqvist, Aa.; Colschen, R. (Lund univ. (SE). Kemisk apparatteknik). (Swedish National Board for Technical Development, Stockholm; Lund Inst. of Tech. (Sweden). Dept. of Chemical Engineering). 24 Sep 1987. 73p. (In Swedish). (LUTKDH/TKKA—7007-1-25-1987). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88755899/JAW.

A computer codes system is under development for simulation of absorption cycle heat pumps. The codes will simulate different absorption cycles using any working media. It will be used for analyses of possibilities and application, dimensioning and optimization, and test evaluations of various absorption heat pumps.

11244 **(SV-UL—1987-51) Rock heat plants with direct vaporization. Operational results and experiences.** Spante, L.; Bylander, P. (Swedish State Power Board, Aelvkarleby). 20 Nov 1987. 27p. (In Swedish). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755913/JAW.

Three ground source heat pump systems using direct evaporation in copper pipes in boreholes, with heat power between 6 and 20 kW were installed 1985, and have been monitored for two heating seasons. The investment costs for systems with direct evaporation for one-family house use, are some ten percent lower than for the traditional indirect systems. The refrigerant volumes used are 2-3 times higher than for the indirect system. In order to reduce harmful environmental side-effects, the working fluid R22 was used. The operational results have been in accordance with the design figures. The COP was measured to be 2.6 for a yearly mean heat extraction of 30W/meter borehole. (L.E.).

11245 **(TTKK-LT—55) Computerized control of heat pump components.** Lasander, R. (Tampere Univ. of Tech. (Finland). Thermal Engineering). 1987. 81p. (In Finnish). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88755925/JAW.

The goal of this investigation was to design and construct a computer control and measurement program for the testing rig of heat pump components. The main weight was attached to control algorithms suitable for variable dynamic properties of different components. The dynamic behaviour of components were determined as step responses for evaluation of the parameters of the control algorithms. Mainly two control strategies were tuned and tested: separate PID-controllers and a multivariable control system. A short outline of an adaptive control is given. The computer control program is designed to be so flexible as possible for future changes of the system.

11246 **(TTKK-LT—59) Control of vaporization process.** Saeynaejoki, J. (Tampere Univ. of Tech. (Finland). Thermal Engineering). 1988. 70p. (In Finnish). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88755926/JAW.

The aim of this study was to design a computer program to simulate the operating and control functions of the cooling and heat pumps systems. The software has a modular structure, which facilitates and simplifies its application in practice. The program SIMU has been designed for simulation purposes. A functional subprogram has been designed to calculate thermodynamic properties. Test runs with these programs have been done and the results are shown in figures.

11247 **(UCRL—99591) Household exposure models.** McKone, T.E. (Lawrence Livermore National Lab., CA (USA)). 1988. Contract W-7405-ENG-48. 32p. (CONF-8811128—1). NTIS, PC A03/MF A01 - OSTI. Order Number DE89004886/JAW.

From 18. conference on toxicology; Fairborn, OH, USA (1 Nov 1988).

Human exposure to volatile organic compounds (VOCs) in tap water is often assumed to be dominated by ingestion of drinking water. This paper addresses the relative importance of inhalation and dermal exposures in a typical household. A three-compartment model is used to simulate the 24-h concentration history of VOCs in the shower, bathroom, and remaining household volumes as a result of tap water use. Mass transfers from water to air are derived from measured data for radon and used to estimate mass-transfer properties for VOCs. The model is used to calculate a range of concentrations and human exposures in US dwellings. The estimated ratio of household- inhalation uptake to ingestion uptake is in the range of 1 to 6 for VOCs. We use a dermal absorption model to assess exposure across the skin boundary during baths and showers. The ratio of dermal exposure to ingestion exposure is in the range 0.6 to 1. 24 refs., 1 fig., 7 tabs.

11248 **(VTT-TIED—836) Insulated cavity brickwall. Temperature and moisture variation in the wall and movements caused by them.** Harmaajaervi, R.; Sipari, P. (9698851FI;). (Valtion Teknillinen Tutkimuskeskus, Espoo (Finland)). Feb 1988. 59p. (In Finnish). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88755928/JAW.

Design and erection of masonry wall of high quality requires good knowledge of the action of the structures in natural circumstances. For durability the most important factors are moisture and temperature variation in the wall. The publication includes a survey of foreign literature. The measuring results and research methods are presented. The moisture contents and temperatures in the outer and inner leaves have been measured between autumn 1984 and spring 1985. The freezing and thawing cycles of the outer leaf in insulated cavitywall are presented. The maximum thermal variations in wall are presented. Movements caused by moisture and temperature are given.

11249 **(VTT-TIED—838) Requirement-adapted industrial ventilation and sensor technology.** Malinen, J.; Tapola, M.; Uimonen, J. (Valtion Teknillinen Tutkimuskeskus, Espoo (Finland)). (Valtion Teknillinen Tutkimuskeskus, Espoo (Finland)). Feb 1988. 101p. (In Finnish). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88755929/JAW.

This publication is divided into two parts: the first part deals with the feasibility of a requirement-adapted ventilation system in industrial buildings. The second concentrates on techniques for measuring gas and vapour phase contaminants in workplace air. In the first part a short review on the most common contaminants and in several industry branches will be given. The most common contaminants, excluding particles, are: solvent (vapors), carbon monoxide, and other combustion products. Air quality sensors will be discussed based on experience and product brochures. The main characteristics of semi-conducting oxide gas sensors were measured in a test room in stable conditions. The second part deals with the application of semiconducting oxide gas sensors and infrared absorption techniques to ventilantion control measurements. Semiconducting gas sensor characteristics as well as research activity and sensor feasibility in ventilation control applications are reviewed. The infrared absorption method is discussed, starting from the physical base of gas IR-absorption and continuing to concentration measurement techniques.

11250 **(VTT-TIED—839) Model of new industrial building production.** Korhonen, P.; Mertanen, J.; Ratvio, J.; Sarja, A. (9698851FI;). (Valtion Teknillinen Tutkimuskeskus, Espoo (Finland)). May 1988. 56p. (In Finnish). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88755930/JAW.

The probable construction technology as well as the planning, control and organization model of the future are studied with stress laid on the building site and its functions. The aim of the general planning and control model of building production has been to apply logistics, controllability analysis and JOT-production philosophy to building production and to use information and knowledge technology as a tool in the system. The study is based on two alternatives: industrial construction on building site and industrial construction by means of assemblying techniques of prefabricated components. Logistics schemes of information and material streams of a future building project have been made. The focus is on the construction of offices and dwelling houses by total contract and a general model for these kinds of operations in future has been outlined.

11251 **(VTT-TIED—846) Temperature control in water heating systems. Thermohydraulic analysis.** Laitinen, A.; Kohonen, R. (Valtion Teknillinen Tutkimuskeskus, Espoo (Finland). LVI-tekniikan Laboratorio). (Valtion Teknillinen Tutkimuskeskus, Espoo (Finland)). May 1988. 109p. (In Finnish). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88755931/JAW.

The purpose of heating systems is to maintain thermal comfort conditions in the building during the occupied hours. When the control system works well the thermal comfort conditions can also be obtained energy economically. In this case, the internal and external heat gains are exploited effectively. Operation conditions of the control system are created with correct dimensioning of the prosess. A number of recommendations on how to design and instal a well-controllable water heat distribution network will be presented based on computer simulation and labortory tests. It is essential to assure high authority of control valves in all operation conditions by means of right dimensioning. The right dimensioning principles are to separate the network into control loops, to use by-pass valves or differential pressure control valves and to use loose pipe dimensioning.

3202 Transportation

REFER ALSO TO CITATION(S) 11295, 11716, 12461

11252 (DLC—7004) A comparison of modal energy consumption in intercity freight. Phase 1. Study feasibility. (DelCan DeLeuw Canada Ltd.). 1979. 251p. (CE—02126). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

This report is a feasibility study of a research project intended to determine the quantitative difference between direct energy consumption of truck and rail transport in Canada for some typical competitive intercity freight moves. Within this study's scope, 3 basic components of goods movement are analyzed: pickup and delivery, terminal costs for trans-shipment between the pickup or delivery vehicle and the line-haul vehicle, and the line-haul component. Important measurements to be considered in terms of overall national objectives and the decision to utilize the road or rail mode are: energy consumed, level of service, costs, marketing strategies, loading/unloading requirements, and security. Many of these measurements are reflected in a number of analysis issues presented. Such issues include safety and environmental considerations, apportioning energy costs in facilities sharing use with non-freight transport modes, the time used in the movement, and extra costs resulting from empty back hauls. Case studies are proposed which take into account the parameters affecting assessment of the viability of either mode, and their influence on the relative efficiency of each mode. The availability of data for each component of the move is evaluated, and approaches to further data collection are suggested. Currently available computer simulation models were examined as investigative tools. A work plan is presented for the next phase of the study, to involve collecting information to establish both the marginal and and average costs of moving goods by each mode, with final analysis provided in Btu per ton-mile. Includes annotated bibliographies. 59 refs., 23 figs., 13 tabs.

11253 (DOE/CE/15277—T1) Alleviation of fuselage form drag using vortex flows: Final report. Wortman, A. (ISTAR, Inc., Santa Monica, CA (USA)). 15 Sep 1987. Contract FG01-86CE15277. 67p. NTIS, PC A04/MF A01 - OSTI; 1; GPO Dep. Order Number TI89004158/JAW.

The concept of using vortex generators to reduce the fuselage form drag of transport aircraft combines the outflow from the plane of symmetry which is induced by the rotational component of the vortex flow with the energization of the boundary layer to reduce the momentum thickness and to delay or eliminate flow separation. This idea was first advanced by the author in 1981. Under a DOE grant, the concept was validated in wind tunnel tests of approximately 1:17 scale models of fuselages of Boeing 747 and Lockheed C-5 aircraft. The search for the minimum drag involved three vortex generator configurations with three sizes of each in six locations clustered in the aft regions of the fuselages at the beginning of the tail upsweep. The local Reynolds number, which is referred to the length of boundary layer run from the nose, was approximately 10^7 so that a fully developed turbulent boundary layer was present. Vortex generator planforms ranged from swept tapered, through swept straight, to swept reverse tapered wings whose semi-spans ranged from 50% to 125% of the local boundary layer thickness. Pitch angles of the vortex generators were varied by inboard actuators under the control of an external proportional digital radio controller. It was found that certain combinations of vortex generator parameters increased drag. However, with certain configurations, locations, and pitch angles of vortex generators, the highest drag reductions were 3% for the 747 and about 6% for the C-5, thus confirming the arguments that effectiveness increases with the rate of upsweep of the tail. Greatest gains in performance are therefore expected on aft loading military transports. 10 refs., 11 figs., 1 tab.

11254 (NEI-DK—104) Examination of the energy and emission situation in relation to the possibility of a bridge being built over the Great Bealt. (Risoe National Lab., Roskilde (Denmark)). May 1988. 93p. (In Danish). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88755787/JAW.

The Danish government is considering the implications of building a bridge over the Great Belt, the stretch of waters between the island of Funen and Zealand, as an alternative to transport by ferry which is at present (1988) the only means of communication between the islands for trains and road vehicles. A bridge would result in a change in the pattern of traffic between East and West Denmark and thus also in the amount of energy used. The two contrasting situations of continued ferry transport, and of road and rail traffic using a bridge over the Great Belt after 1996, are examined in the light of energy consumption and air pollution from exhaust gases. It was found that in spite of the expected increase in traffic volume in 1996, there would be a reduction in energy consumption in relation to transport between East and West Denmark if a bridge was built, because ferries consume more energy crossing the waters than would road and rail traffic when crossing the waters by the 18 km. long bridge. The reduction in energy consumption would be 1-2% of that of the total within the transportation sector. This would mean a saving of 96 million Danish Crowns (1988 prices, excluding duties). There would also be a reduction in air pollution, sulphur dioxide emission would decrease by 6-7%, and emission particles by 2%. Emission of hydrocarbonates, nitrogen oxides and carbon monoxide would remain more or less constant. The energy consumption involved in the actual construction of the bridge would be "repaid" in the course of three years because by then the same amount of energy would have been saved by substituting road and rail transport over the bridge for the ferry routes. (AB).

11255 (PB—89-113682/XAB) Traffic zones reconsidered: a geographical examination of zonal restructuring for system-wide mass-transit-ridership forecasting. Final report. Lindquist, P.S. (Wisconsin Univ., Milwaukee (USA). Center for Urban Transportation). Aug 1988. 186p. NTIS, PC A09/MF A01.

One of the major problems encountered in urban mass-transit-ridership forecasting is that existing traffic-zone systems are not compatible with the service areas of transit routes. Existing traffic-zone boundaries rarely coincide with those of service corridors. This inconsistency can lead to erroneous ridership estimates. This study attempts to restructure the zone system to account for passenger accessibility in system-wide transit-ridership forecasts. The study identifies and addresses three major problems to overcome in zonal restructuring: (1) the development of an efficient zone-construction algorithm; (2) the efficient transfer of data from the traffic-zone system into the transit-zone system; and (3) the minimization of modifications to the overall modeling process for all modes of travel. An automated zone reconstruction procedure was developed to build an alternative zone system by overlaying service corridors over the existing traffic analysis zones. This procedure provides data for mode split and trip assignment, where weighted disutilities are calculated for mode split and trips are allocated to and from individual subzones during trip assignment.

11256 (PB—89-117543/XAB) Development and demonstration of marketing techniques for establishment of ride-sharing corporations in New York State. Final report. Peters, E.W. (Island Rides, Inc., Melville, NY (USA)). Oct 1987. 124p. NTIS, PC A06/MF A01.

Convincing commuters to join car or vanpools can be a challenging task. Through the Energy Authority project, two guides were produced to assist in establishing ride-sharing corporations and in marketing ride-sharing services in New York State. The first guide explains how to set up a ride-sharing corporation; the second guide, developed following the completion of a Commuter Behavior Study and a six-month demonstration, discusses marketing ride-share services. The Commuter Behavior Study centered on an 18-page questionnaire mailed to 6,000 households in Long Island and upstate New York. The study's findings were incorporated into a marketing plan followed by the contractor, Island Rides, a Long Island-based ridesharing corporation, during a six-month demonstration project. By using the promotional techniques identified in the study, Island Rides experienced a 68% increase in ride-sharing applications during this successful demonstration. The results of both the study and the demonstration are presented in the report.

11257 **(PB—89-117683/XAB) Development of fuel consumption and vehicle-emissions relationships for congested-freeway flow conditions. Final report, July 1986-May 1988.** Lindley, J.A. (Federal Highway Administration, McLean, VA (USA). Office of Safety and Traffic Operations Research and Development). Aug 1988. 109p. (FHWA/RD—88/205). NTIS, PC A06/MF A01.

Fuel consumption and vehicle emissions are commonly used measures of effectiveness for describing differences between freeway improvement alternatives. However, current sketch planning relationships between fuel consumption and vehicle emissions and parameters that can be measured over time, such as average speed, are inadequate because they use out-of-date assumptions about the vehicle fleet, they do not apply to the entire range of congested freeway operating conditions, and/or they are based on assumed rather than actual vehicle operating patterns. This study examined several types of relationships between fuel consumption and vehicle emissions and various operating parameters, and tested them. The more practical of these relationships use total distance traveled and total travel time as independent variables. These relationships are very highly correlated for both total fuel consumed and total emissions of the three major types of pollutants. These relationships were calibrated for the data used in the study. A computational example of the potential usefulness of the relationships developed is given.

11258 **(PB—89-118277/XAB) Fishing-vessel fuel-conservation project. Final report, 25 June 1986-31 December 1987.** (California Sea Grant Extension Program, Davis (USA)). 1987. 38p. NTIS, PC A03/MF A01.

The Sea Grant Extension Program (SGEP) is the University of California's statewide education link with the commercial-fishing industry. SGEP's seven county-based marine advisors and three statewide specialists use applied research, demonstrations, workshops, publications, mass media, and individual consultations to help the industry put research-based information to work. SGEP has worked with the fishing industry for fifteen years. Two major ongoing long-term problems of the fishing industry have been chronically low-income levels and full- or over-exploitation of fish stocks. These problems were especially severe during the first half of the 1980s. With most fish resources fully utilized, one of the only means of improving the situation is improved economic efficiency, especially through fuel conservation. Fuel costs represent a large portion of most fishermen's variable costs.

11259 **(TC/OSS—8805) Evaluation of the energy performance of the Quebec transport sector.** (Transport Canada, Ottawa, Ontario. Office of Strategic Studies). 1980. 321p. (In French). (CE—02122). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

The objectives of this study are to assemble available information on transport demand and energy consumption in the Quebec transport sector, and to display the collected information in such a manner as to: allow comparison of the historical evolution of transport demand/energy consumption; show the structure of such demand/consumption in order to facilitate understanding of their relationship with external factors; and furnish, by means of illustration, a framework for approaching an analysis of the impact of measures designed to conserve or substitute energy, or to establish energy priorities. The study presents a summary of data by market (passengers and freight), mode, energy conservation and substitution measures used in the various modes, and energy priorities during emergencies. The bulk of this document presents transport demand/energy consumption data, plus relevant discussion, of each of the Quebec transport modes (1971-78): automobiles, public transit, taxis, trains, air, trucks, and other modes including school buses, rental cars, motorcycles, snowmobiles, ferries, and pipelines. To achieve the objectives of this study, data collection and analysis efforts were concentrated in the following areas: local or long-distance transport demand by passengers and freight, according to type of vehicle; direct or indirect energy consumption of vehicles, according to passenger or freight use, and according to conditions typical of local or long-distance service; energy consumption associated with vehicle maintenance, support infrastructures, and energy production; and energy consumption associated with transport of petroleum and natural gas. 103 refs., 14 figs., 231 tabs.

3203 Industry And Agriculture

REFER ALSO TO CITATION(S) 10851, 10866, 10961, 10961, 10962, 11196, 11204, 11613

11260 **(BFR-R—62-1988) Flue gas condensation with oil heating. The effect on economics and the environment.** Bjoerner, B. (Studsvik Energiteknik AB, Nykoeping (Sweden)). (Statens Raad foer Byggnadsforskning, Stockholm (Sweden)). 1988. 43p. (In Swedish). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755753/JAW.

For a couple of years operation experience and experimental data have been collected from a 685 kW oil-fired boiler equipped with a flue gas condenser. The report presents data and conclusions on heat economy, corrosion and sealing, emission, condensate properties. The concept studied gives at nominal load c. 10% oil saving. The corrosion attack is negligible and the cooler installation leads to environmental advantages. The dust content of discharged flue gas decreases by c. 80%. A reduction of the same order of magnitude has been established for SO/sub 3/. Also the amount of Hg and Cd decreases, the reduction being 30-40%. The condensate can be discharged to the municipal sewage system after neutralization. Total emission is decreased by the energy conservation obtained but also because of concentration of dust and certain trace substances in liquid phase. (O.S.).

11261 **(BFR-R—70-1988) Absorption heat pump in Trollhaettan. Performance evaluation.** Wimby, M.; Franck, P.Aa.; Berntsson, T. (Chalmers Univ. of Tech., Goeteborg (SE). Dept. of Heat and Power Technology). (Statens Raad foer Byggnadsforskning, Stockholm (Sweden)). 1988. 34p. (In Swedish). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755757/JAW.

The heat pump is steam driven, cools a cooling water system, and supplies heat to the district heating system in Trollhaettan. The steam temperature is 150 degrees C and the cooling water minimum temperature is 35 degrees C. During the 27 months evaluation period the capacity factor amounted to 63%. At start-up power losses were incurred because of difficulties in adaption to the district heating system. A heat exchanger failure caused 2 months shut-down. Excluding this, the availability was 100%. The heat pump requires a minimum of manual service supervision. (O.S.).

11262 **(DOE/CE/15217—T10) Apparatus and method for direct application of treatment liquid to growing vegetation: Final program report.** (Acra Industries, Inc., Colfax, LA (USA)). 14 Dec 1988. Contract FG01-85CE15217. 49p. NTIS, PC A03 - OSTI. Order Number DE89004461/JAW.

The purpose of this Grant was to develop a commercial design of a new technology for direct application of treatment liquid to growing vegetation. Development of the prototype has been directed largely to application of translocating herbicides to grass infestation in field crops. A successful prototype has been developed, operated extensively and test marketed on a limited basis. The prototype is believed to be commercially producible. When built on a production basis, it should provide a highly cost effective weed control option. The product is believed to be adequately developed to proceed with further test marketing, preliminary planning and preparation for product introduction. 16 figs.

11263 **(DOE/CE/40545—25) Diagnosis of sources of current inefficiency in industrial molten salt electrolysis cells by Raman spectroscopy.** Sadoway, D.R. (Massachusetts Inst. of Tech., Cambridge (USA). Materials Processing Center). 29 Jul 1988. Contract FG07-82CE40545. 57p. NTIS, PC A04/MF A01 - OSTI. Order Number DE89004637/JAW.

The purpose of this project was to employ Raman spectroscopy in the study of industrial molten salt electrolysis cells. The objective was to improve the understanding of the chemistry and electrochemistry of the relevant melt systems and, in turn, of energy loss mechanisms in the industrial processes. On this basis

new ways to improve the energy efficiency of these industrial reactors might be identified. The research plan has several principal elements. First, there was the design and construction of laboratory scale representations of industrial molten salt electrolysis cells that would at the same time serve a spectrocells. Secondly, there was the mastery of the preparation of the molten salt electrolytes, what in industry is called the "front end." Thirdly, there was the adaptation of commercially available Raman instrumentation in order to facilitate the proposed studies. It is the nature of the specimens that so dramatically distinguished this work from conventional Raman studies for which commercial instrumentation is designed: first, the laboratory scale electrolysis cells are large compared to typical spectrocells; and secondly, the cells operate at, what for Raman studies are, extremely high temperatures. 4 refs., 2 figs.

11264 **(DOE/CE/40777—T1) On-machine sensors to measure paper mechanical properties, Report No. 1.** Hall, M.S.; Habeger, C.C. Jr. (Institute of Paper Chemistry, Appleton, WI (USA)). Oct 1988. Contract AC05-86CE40777. 61p. NTIS, PC A04/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005579/JAW.

This project is a four-year program which began October 1, 1986. The work may be separated into two distinct parts and four phases. Part I (Phases 1 and 2) is being emphasized to date, and Part II (Phases 3 and 4) will be initiated upon successful completion of Part I. Part I of this project is specifically concerned with the development of a sensor to make on-machine measurements of elastic stiffness in the thickness direction of the paper and the integration of this sensor with an appropriate in-plane sensor. Upon completion of Part I (Phases 1 and 2), we expect to be able to independently monitor the effects of refining, jet-to-wire speed ratios, and draws (and the related drying restraints) on paper properties. This means that we should be able to control these three machine variables continuously and independently during the manufacturing process. Part II of the project will then be concerned with the development of algorithms, hardware, and software necessary to control these variables on the paper machine in the machine direction (Phase 3) and the cross-machine direction (Phase 4). Project objectives call for a successful demonstration of the sensor and control scheme on a laboratory scale paper machine. Success would lead to further work on a pilot scale and eventual scale-up to a full size paper machine. 22 refs., 19 figs., 5 tabs.

11265 **(DOE/ID/12232—1-Pt.1) Energy efficient membrane processes for the separation of organic liquids: Part 1: Final report, September 28, 1982--December 31, 1986.** Cabasso, I.; Acharya, H.R.; Korngold, E.; Liu, Z.; Stern, S.A.; Li, W.; Makenzie, T.; Poda, E. (State Univ. of New York, Syracuse (USA). Coll. of Environmental Science and Forestry). Oct 1987. Contract AS07-82ID12232. 195p. NTIS, PC A10/MF A01 - OSTI; 1; GPO Dep. Order Number TI89002404/JAW.

The potential usefulness of two membrane processes, namely, pervaporation and perstraction, for separating azeotropic mixtures of aromatic and aliphatic hydrocarbons was studied theoretically and experimentally. A third membrane process, osmotic phase-separation, was investigated experimentally. The separation of an azeotropic mixture of benzene and cyclohexane was used as an example. Part II of this report will discuss membrane processes for the separation of alcohol/water mixtures. Mathematical models of pervaporation and perstraction were developed for computer simulations of the processes. The perstraction model presented herein is the first of its kind. Additionally, the energy requirements and capital investments costs for the separation of an azeotropic benzene/cyclohexane mixture were determined and compared with those for extractive distillation. 31 refs., 64 figs., 19 tabs.

11266 **(DOE/ID/12232—1-Pt.3) Energy efficient membrane processes for the separation of organic liquids: Part 3 (Supplement report): Final report, September 28, 1982--December 31, 1986.** Cabasso, I.; Acharya, H.R.; Korngold, E.; Liu, Z.; Stern, S.A.; Li, W.; Makenzie, T.; Poda, E. (State Univ. of New York, Syracuse (USA). Coll. of Environmental Science and Forestry). Oct 1987. Contract AS07-82ID12232. 53p. NTIS, PC A04/MF A01 - OSTI; 1; GPO Dep. Order Number DE89002487/JAW.

In this supplemental report, two pilot plants are described. The first is air purge pervaporation (or air sweep pervaporation hollow fiber system) for the separation of azeotropic aqueous liquids. The second describes pilot plant construction and operation for the perstraction process. Several configurations for the air purge pervaporation process were studied and were shown to yield high purity products e.g., isopropanol from the azeotropic mixture with water was enriched to 99.9%. Parallel and U-module configuration were used and durability experiments up to 120 days were carried out successfully. The report describes the first successful low scale pilot plant unit and elements for perstraction process. The conclusion and outcome of this study are two fold. First, membrane systems in a pilot plant unit proved to be very efficient in upgrading nonpermeable components in a membrane system and especially when dealing with azeotropic mixtures. For example, more than 99% isopropanol can be produced from a feed liquid which is 88% i-PrOH (azeotropic mixture with water). The membrane system proved to be durable within the time limit of the experiments (120 days). Second, all parameters including the various configurations of the pilot plants (which are still being studied) are available for chemical, petroleum, and other US industries. 3 refs., 22 figs., 2 tabs.

11267 **(DOE/ID/12303—4) Fluidized bed waste heat recovery system: Annual report March 1, 1984--February 28, 1985.** (Aerojet Energy Conversion Co., Rancho Cordova, CA (USA)). Jul 1985. Contract FC07-81ID12303. 82p. NTIS, PC A05/MF A01 - OSTI. Order Number DE89002083/JAW.

The continuing Fluid Bed Waste Heat Recovery System (FBWHRS) development progress is reported covering a twelve-month period from March 1984 through February 1985. During this period the advanced, self-cleaning waste heat boiler was constructed, shipped to the test site at Melting Furnace No. 34, ALCOA, Massena, New York, installed and operated. Hot (2200{degree}F), dirty, aluminum melter waste stack gas is used by the FBWHRS to generate plant steam. Several development problems were encountered and overcome. Checkout and development testing per the Test Plan was completed through commissioning and the seven month Evaluation Test was started which is scheduled for completion on 2 September 1985. Operation of the FBWHRS by ALCOA is expected to continue for many years. Four flue gas corrosion and fouling probes were used to characterize the relative corrosion susceptibility of ten selected metal alloys in the same No. 34 Melter flue gas flow. These four probes inserted into the aluminum melter flue were maintained by controlled air cooling at constant respective temperatures of 1100{degree}F, 900{degree}F, 700{degree}F, and 500{degree}F. A Bench Scale (1/30 scale) Test Unit was also fabricated, shipped to Aerojet (Sacramento, California) Test Area "A" and installed. Testing proceeded per the Bench Scale Test Plan through 1100{degree}, 1400{degree}, and finally 1600{degree}F Bench Scale tests. A fouling probe for characterizing the high temperature exhaust gas generated by the Bench Scale burner operating on No. 6 fuel with and without Arol 456SV fuel additive was also provided. 10 refs., 40 figs., 12 tabs.

11268 **(DOE/ID/12553—2) Separation, fractionation, concentration and drying of food products: Final report, March 4, 1987--March 31, 1988.** Merlo, C.A.; Rose, W.W.; Pedersen, L.D.; Brewbaker, P.L. (National Food Processors Association, Dublin, CA (USA)). Mar 1988. Contract AC07-84ID12553. 84p. NTIS, PC A05/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004638/JAW.

This project studied energy efficient processes for separation, fractionation, concentration, drying, and recombination of food products, in order to reduce energy requirements for processing, preservation, and transportation. The project had three phases. In the laboratory-scale phase, results of which are summarized in this report, tomato puree was separated by three methods: conventional vacuum filtration, centrifugation, and crossflow microfiltration to produce pulp and serum. Three methods of recombination were examined: homogenizing, stomacher blending, and static (in-line) mixing. Satisfactory recombined purees were obtained. In addition, after centrifugation, the pulp was rinsed producing rinsed-pulp, and the rinse water was added to the serum producing rinse/

serum. The rinse/serum was concentrated by evaporation. This was recombined with the rinsed-pulp and water producing satisfactory puree. 11 refs., 18 figs., 18 tabs.

11269 **(E/ECE—9003098) Economic desirability of extensive utilization of the heat of natural-gas combustion products.** (United Nations, Geneva (Switzerland). Economic Commission for Europe). 31 May 1988. 3p. OSTI - United Nations Economic Commission for Europe, Palais des Nations, 1211 Geneva 10, Switzerland. Order Number TI89003098/JAW.

11270 **(EFP—97) Dry desulfurization product as raw material for building components.** Nielsen, J.P.; Tram, B. (Bent Tram Consultants, Aalborg (Denmark)). May 1988. vp. (In Danish). Loan from Risoe Library, DK-4000 Roskilde.

EFP-87.

The report describes a number of investigations carried out with the purpose of finding useful applications for a waste product form the flue-gas cleaning process at coal-fired power plants, especially applications in the field of industrial building components. The waste product originates from a cleaning device, where the content of sulphur dioxide is removed from the flue-gas by the so called spray absorption method, developed by the Danish company Niro Atomizer A/S. The product is a finely divided, dry powder, consisting of a mix of calcium sulfite, calcium sulfate, calcium hydroxide, calcium carbonate, calcium chloride and fly ash. Trials were made, using the waste product mainly as a filler in the following products: Brick mortar, flue for ceramic tiles, stopping, filler for plastic paint, filler for plastics, filler for paper and paper-coating, autoclaved light-weight concrete, autoclaved fibre-cement sheets. The investigations has shown some interesting possiblilities for the use of named waste product in light-weight concrete, where good mechanical properties could be obtained, using a raw material mix, consisting mainly of the sulfuric waste product and fly ash. Also used as a filler in fibre-cement sheets, the waste material showed some interesting abilities. The waste product affects the properties of cellulosefibre reinforced sheets with a cementsilica matrix in a way, that leads to increased toughness of these, often rather brittle sheets. The MOR however will decrease slightly. (EG).

11271 **(FRNC-TH—3376) Energy and its crisis from 1974 to 1984 in French agriculture-economic analysis.** Bonny, S. (Institut National Agronomique, 75 - Paris (France)). May 1986. 497p. (In French). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88756320/JAW.

The impact of the energy crisis on French agriculture has been carried out along two main directions: - the study of energy in agriculture from a quantitative (estimation of energy consumptions), historical and economic point of view: importance of energy expenses in economic results and in production costs, relationships between energy consumption and economic results, combination with other production factors. The analysis of energy use is operated at different levels of production, farm units, farm sector or food and farm product processing system. - detailed analysis of the impact of the energy crisis on French agriculture from 1974 to 1984 (the impacts of the more general crisis are studied at the same time). First a simulation study is carried out on different production systems (large-scale crop production and dairying) of a sharp rise in energy prices or a petrol rationing: impact on the choice of crops, on the economic results, on the energy consumption, etc. Secondly, the investigation deals with the whole French agriculture in a more concrete manner. The evolution of direct farm unit energy consumptions from 1977 to 1981 is analysed (which corresponds partly to the second petrol crisis) as well as the impacts of the increase in energy prices on different particularly sensitive activities: corn drying, fodder dehydration, hot-houses and fertilization. Other consequences of the energy crisis are then dealt with such as the decrease in farm incomes, choice of productions, farm and food trade. The debate on farm production models which resulted of the energy crisis is subsequently discussed. The investigation shows economics of energy for heating purposes, a diversification of fuels, the development of the use of wood for heating houses and an increase in electricity consumption.

11272 **(NEI-DK—113) Energy conservation in relation to industrial refrigerating plants.** Bay Moeller, L.; Monrad, K.; Jantzen, O. (Jysk Teknologisk, Aarhus (Denmark)). Nov 1986. 99p. (In Danish). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88755794/JAW.

The theoretical background and method of analysis as the basis of an evaluation of industrial cold storage plants energy economy is explained. The factors which influence the accumulation of energy, are stressed and a calbulation model is presented. The method is based on relatively simple measurements, and facilitates analysis and description of the working of a complex cold store. The concept of exergy is defined and an analysis of exergy losses for each component in the installation is carried out. From this it can be seen that based on pressure and temperature measurements only it is possible to calculate each procedure's percentage of the total amount of energy carried to the compressor and this makes it possible to calculate a series of key numbers that describe in what part of the cold store it is most suitable to conserve energy and can be used to compare different cold store combinations. Suggestions are given for saving energy in relation to industrial cold stores generally. (AB).

11273 **(NEI-DK—117) Construction and testing of a small dual-fuel motor using diesel oil and methane.** Weber, J. (Lydda Smede- Maskin- og Motorvaersted, Stenstrup (Denmark)). Jan 1987. 112p. (In Danish). NTIS (US Sales Only), PC A06. Order Number DE88755798/JAW.

A standard diesel motor was converted to a dual-fuel motor running on diesel oil and methane, and performance tested. It is concluded that such a convertion is economically acceptable and mechanically efficient. For farm use it is recommended to use, in addition, a self-magnetizing synchro-generator together with the necessary synchronizing equipment so that the installation could be used for emergency electric power. Guidelines for the construction and operation of the dual-fuel motor are given. (AB).

11274 **(NEI-FI—52) Computerized control of a paper machine steam and condensate system.** Ylhaeisi, M. (Insinoeoeritoimisto Air-Ix Oy, Tampere (Finland)). (Kauppa-ja Teollisuusministerio, Helsinki (Finland). Energiaosasto). Dec 1987. 15p. (In Finnish). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755813/JAW.

Because of the paper machine steam and condensate system is particularly suited for computerized control. United Paper Mills, Jaemsaenkoski PM 4 was equipped with a computer control system by means of Alcont automation system. The developed gliding differential pressure, maximizing the pressures, correction of the curlying effect and adfustable steam grouping are presented in this report. Following advantages have been registered with the computerized control system during the follow period: the heat effect of the condenser is reduced on avarage by 1.35 MW and the variations of the heat effects are clearly smaller, specific energy consumption is 0.85 kg steam/kg paper lower. Added infrared dryers after the coating stations are partly affecting to this lower figure, operational differential pressures of steam groups were reduced e.g. a. 0.25 bar in the 3rd steam group and a. 0.13 bar in the 2nd steam group, the drying capacity of the predryer section was increased 3-5%, the pressure adjustability of each drying cylinder separately in the first steam group have lowered the risk of web picking on the cylinders, computer control system has released the paper machine operators to have more time to other activities, the predryer section can be run with lower pressures when using not the total drying capacity because of the reduced differential pressures. The only noticed disadvantage is that inaccurate measuring data is causing more troubles than earlier. The operation assurance of Alcot system hasn't been any problem. The machine operators have easily adopted the clear and simple terminal operation. The flexibility is good and the modification of the mathematical modelling is easy. The developed system has been applied by Christmas 1987 in five other machine. The basic developed solutions can be adapted to all the machines in Finland.

11275 (NEI-FI—59) Heat treatment of steel and energy conservation in Lokomo Steel Works. Tennilae, P. (Neles Oy, Tampere (Finland)). Jun 1987. 76p. (In Finnish). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88755820/JAW.

During the years 1984-1987 an energy project has been carried out at the Lokomo Steel Works under support from the Ministry of Trade and Industry. The main goals of the project have been as follows: measures of saving district heating energy, renewing the heat treatment of steel castings, improving the control of use of energy. The estimate of the total cost of the project is 3.785 millions FIM. The costs of the project until March 31, 1987 have been 3.3 millions FIM. The Energy Department of the Ministry of Trade and Industry has granted 1.7 millions FIM for the financing of the project. The total annual savings achieved by the project are about 3.3 millions FIM.

11276 (NP—9770183) System and loss analysis of different types of refrigerant compressors. Kaiser, H. (Deutscher Kaelte- und Klimatechnischer Verein e.V., Stuttgart (Germany, F.R.); Hannover Univ. (Germany, F.R.). Fakultaet fuer Maschinenwesen). 1985. 194p. (In German). NTIS (US Sales Only), PC A09/MF A01. Order Number DE89770183/JAW.

Loss and performance measurements were carried out on four different compressors (lifting-piston, rolling-piston, vane-cell, and rotary-piston compressor) with the ultimate goal of reducing compressor losses. Indicator diagrams were established in order to determine the loss components. Precalculations of real compressor behaviour were made on the basis of simple equations and programs. The findings suggest that all types of compressors are nearly identical with regard to efficiency once the losses are minimized. (HWJ).

11277 (NP—9770198) Energy-heat-coupling with waste heat from a discontinuous manufacturing plant. Final report. Beier, W.; Kaskas, A.; Bechtel, S.; Getschmann, E.; Germersheim, K. von; Klages, R.; Kokoska, W.; Moehring, H.G.; Piasny, E.; Schmidt, A. (Hoesch Werke A.G., Dortmund (Germany, F.R.); Hoesch Stahl A.G., Dortmund (Germany, F.R.)). (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.); Hoesch Werke A.G., Dortmund (Germany, F.R.); Vereinigte Elektrizitaetswerke Westfalen A.G. (VEW), Dortmund (Germany, F.R.)). Oct 1987. 148p. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE89770198/JAW.

The sensible heat contained in the hot exhaust gases (ca. 650/sup 0/C) of pusher type furnaces at the wide strip rolling mill of the Hoesch Stahl AG shall be adjusted for energy-heat coupling, i.e. for the generation of steam and superimposed power. The remaining energy shall be fed directly into the net of long-distance-heat of the VEW. The project is divided into subprojects, i.e. an energy-project (promoted by the BMFT) and a local distance-heat project promoted by the state of North-Rhine Westphalia. The complete plant is finished and has been put in operation in January 1986. This project is distinguished from all other projects, by the fact that an energy-head coupling with direct steam supply was built into the network of the VEW. From February 1986 to January 1987 an average 32.200 t steam/month was produced in the heat boiler, 3.600 t from the additional firing and 28.600 t, adequately 76.700 GJ, from the waste heat. The operating time was 7.516 h/a in the mentioned period. The fraction of the steam produced by the coke oven gas decreased continuously from 28,5% during the starting operation to 4% due to optimized controlling. The generation of auxiliary power was 12.350 MWh/a. Compared with separate production of steam and current results in an energy-saving of about 1,1 Mio GM corresponds to 26.000 t mineral oil per year. Beside this energy-saving there are many advantages concerning the emission and pollution of atmosphere of the city of Dortmund. (orig.) With 46 figs.

11278 (PB—89-110787/XAB) Subway-tunnel energy study. Final report, 1985-1988. Levinson, J.; Knapp, E.; Gonzalez, J.; Douglass, E. (Philadelphia Dept. of Public Property, PA (USA)). Jul 1988. 113p. NTIS, PC A06/MF A01.

The idea of the Subway Tunnel Energy System was conceived by Joel Levinson of Levinson Zaprauskis Associates (LZA), and proposed to the City of Philadelphia in 1981. LZA believed that a study of the feasibility of using subway-tunnel air as a heat sink/heat source to reduce the costs of heating and cooling buildings adjacent to the tunnel might also prove beneficial. Cities including Philadelphia might be able to generate revenues from the sale of the tunnel air to building owners or offer free access to the tunnel air as an incentive to real estate developers who might otherwise choose to build elsewhere. This might also reduce energy consumption in the long term by increasing the use of in-place mass-transit systems. After investigating various directions during Phase 2, LZA concluded that the STES would not prove cost effective in the economic energy climate of today. The report outlines the research results of the STES Study and provides a task by task description of the research process followed by LZA and its consultants through to the point of termination.

11279 (PB—89-111298/XAB) Unique stove process for obtaining high blast temperature with low-caloric-value BG top gas. Technical report. Dai, J.; Lu, L.; Zhang, X. (Beijing Central Engineering and Research Corp., BJ (China)). 1987. 9p. NTIS, PC E03/MF A01.

High blast temperature is one of the necessary conditions for reducing the fuel consumption of blast-furnace operation. Especially in case of using blast gas not enriched with oxygen, the specific injected fuel amount directly depends upon the hot blast temperature. With the reduction of fuel ratio, top gas is debased evidently. Nowadays, for blast furnaces operated with low fuel ratio, the caloric value of dry BF gas has already decreased to 700 kcal/normal cu m (2930 kJ/normal cu m). Obviously, if no additional measures are taken, it is absolutely impossible to achieve the required hot blast temperature for modern blast furnaces with that-low BF gas. In regard to the balance and distribution of the gas energy within an iron and steel works, there is usually a shortage of rich gas. Therefore, it is beneficial to use BF gas as fuel for heating stoves. Thus, a problem arises about how to obtain high blast temperature only with low-caloric-value BF gas. In recent years, many people have engaged in the research and development of the subject. In the paper, the authors introduce the theoretical bases and advantages of the self-preheating stove process. The comparison between the process and other stove processes has been discussed in previously published papers.

11280 (SBI-Landbrugsbyggeri—68) Heat consumption and heat exchanger performance in greenhouses using district heating systems. Stroem, J.S.; Hjelmdal Jensen, J. (Statens Byggeforskningsinstitut, Hoersholm (Denmark)). 1987. 84p. (In Danish). Statens Byggeforskningsinstitut, Postboks 119, DK-2970 Hoersholm.

Heat exchanger performance and energy standard was investigated in 1983 in 52 commercial nurseries located near Odense, where pot plants were cultivated, and where circulating water in the nurserys' own heating systems was heated via a heat exchanger. Supply and return temperatures on the primary and secondary side, water consumption and outdoor temperatures were measured. Parameters used to characterize heat exchanger performance were to primary supply temperature, the cooling of the primary water, temperature loss in the heat exchanger and variations in the secondary temperature and energy consumption. (AB).

11281 (STF—11A88026) Operating experiences from a seawater source heat pump at Polplast in Tromsoe. Eggen, G.; Jonassen, O. (Selskapet for Industriell og Teknisk Forskning, Trondheim (Norway)). May 1988. 20p. (In Norwegian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755891/JAW.

The report presents an analysis on the operation performance for a seawater source heat pump plant connected to a heating system in an industrial building. The plant was put into operation in 1985, and the measuring period lasted throughout the years of 1986 and 1987. The detected failures caused by the oversized levels of heat pump output and heat distribution temperatures are evaluated, and methods to improve the operation performance of the plant are discussed and presented. 8 figures, 3 tables.

11282 **(STU—5029) Electric energy consumption by production of high-yield pulp - status, development trends, and research requirements.** Mohlin, U.B. (STFI, Stockholm (SE)). (Swedish National Board for Technical Development, Stockholm). 15 May 1987. 112p. (In Swedish). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88755905/JAW.

The purpose of the report is to point out how energy consumption may be affected by means of different process variables and various process solutions, and also indicate whether this has an influence on the pulp properties profile. The report describes as well the technique utilized today as the new knowledge experienced by research and development, not yet put into practice. The material presented concerns primarily refiner based processes. From wood primary produce reasons, the groundwood pulp process is considered less attractive for Sweden than RMP, TMP and CTMP. Finally, some important research areas are outlined. (O.S.).

11283 **(SVF—297) Deaeration of water for diluting and processing.** Persson, F.; Carlsson, B. (AaF Energikonsult AB, Stockholm (SE)). (Stiftelsen foer Vaermeteknisk Forskning, Stockholm (Sweden)). Mar 1988. 39p. (In Swedish). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755919/JAW.

In this project two plants with expansion deaerators have been followed up. The content of oxygen in the water after the deaerators have been measured at different service conditions. The content of oxygen under the tests was between 10 and 90 μg/l. When no water was produced the temperature in the deaerators decreased and the highest content of oxygen was measured. Under a period at both plants manual valves in the vent pipes were closed when no water was produced. The content of oxygen under this periods was less than 20 μg/l. To have a satisfactory deaeration automatical valves must be installed in the vent pipes. In this project also proposals for equipment for expansion deaeration have been made for two flows, 0.5 and 2 m/sup 3//h, and for steam, hot water and electricity as heating medias. (authors).

3206 Municipalities And Community Systems

REFER ALSO TO CITATION(S) 10705, 11204

11284 **(CONF-8811122—3) Waste minimization case histories at three US Air Force Air Training Command bases.** Suffern, J.S.; Vogel, R.A. (Oak Ridge National Lab., TN (USA); Wan (Lee) and Associates, Inc., Oak Ridge, TN (USA)). 1988. Contract AC05-84OR21400. 36p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89004929/JAW.

From 13. annual environmental quality R and D symposium; Williamsburg, VA, United States (16 Nov 1988).

Waste minimization audits are being carried out at three US Air Force Air Training Command bases: Randolph Air Force Base (AFB) near San Antonio, Texas; Lowry AFB near Denver, Colorado; and Keesler AFB near Biloxi, Mississippi. These audits include detailed surveys of base operations and processes, detailed analytical reports that contain recommendations for waste minimization actions, guidelines to allow bases to maintain and change their own waste minimization programs, and training programs for base personnel. The operations and processes are described in detail, as are the recommendations for waste minimization actions. The cost savings and efficiency increases associated with each recommended action are discussed. The cost savings identified vary in amount from base to base, depending on base size and mission; and range from $42,000 to $644,000 per year. The annualized Return on Investment for the audits varies between 0.4 and 6.4, making them an extremely attractive investment for the sponsoring agency. Payback period for recommended waste minimization options varies from immediate to 10 years, the average being less than 1 year. The institutional factors affecting the success of waste minimization programs are discussed, especially the need for involvement of supply and logistics functions. 2 refs., 3 tabs.

11285 **(DOE/CE/26524—T1) District heating feasibility for Port Jefferson, NY: Final report.** (Burns and Roe, Inc., Oradell, NJ (USA)). 29 Jul 1988. Contract FG01-85CE26524. 205p. NTIS, PC A10/MF A01 - OSTI. Order Number DE89004759/JAW.

This report presents the results of an investigation into the feasibility of implementing a centralized district heating system serving the Incorporated Village of Port Jefferson, New York. The study assesses the potential heating loads, develops in conceptual form the distribution system and central heating plant design and implementation plans, and evaluates the system and customer economics for both conventional boiler and cogeneration district heat sources. The placement of the heat source near the largest heat user will keep the largest pipe size to a minimum length of run. The capital costs for all phases were prepared based on previous experience and vendor's budget estimates. The costs were based on 1987 dollars and escalated to the implementation dates using a general inflation rate of 5%. Since piping is costly, the routing must be planned carefully. The disturbance that is a result of excavation can be minimized by laying the pipe under sidewalks or the shoulder. This will show a savings since replacement of concrete is simpler and less costly than road surface. A sidewalk installation requires less excavation and backfill and usually involves less interference. The recommended plan is to install an 110 KW gas turbine cogeneration plant at St. Charles Hospital. It will supply electricity to the hospital and the excess generation will be sold to LILCO. Steam from the plant would be supplied to the hospital and would also be used to generate hot water for a district heating hot water loop that would service both hospitals, the public schools, office and apartment buildings, and the downtown business district. 11 figs., 17 tabs.

11286 **(EEC—7903) Background paper on waste management product charges.** Hare, M.J. (Economic and Environmental Consultants, Toronto, Ontario (Canada)). 1979. 104p. (CE—02202). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

On a real per capita basis, post-consumer solid waste has been steadily increasing. About 90 wt% becomes landfill. Waste management improvement programs are intended to reduce the level of such waste and to conserve scarce resources, including energy. A national waste management product charge has been suggested as an innovative and effective waste management policy instrument. There is solid economic rationale to use the product charge to establish the social cost for consumer products and to incorporate higher shadow prices for scarce natural resources and energy inputs, when justified. In 1976, the US Interagency Resource Conservation Committee was established to fully investigate waste management policy instruments, and specifically the national product charge initiative. The final assessment model indicated significantly smaller waste management benefits than had been previously developed, and the product charge was not recommended. However, this paper shows that there are many design specifications for a product charge. A larger product charge could induce significant waste management benefits. This paper also comments on some difficulties with the Committee's assessment model. As a summary point, this paper takes the position that the product charge should not be eliminated from Canadian waste management policy instruments, but should receive a comparative assessment with alternatives. Finally, if a product charge were evaluated for Canada, some significantly different Canadian characteristics would have to be recognized. The final section of this paper presents alternative waste management fiscal instruments, waste management assessment principals, and waste management and economic assessment criteria. 16 refs.

11287 **(NEI-DK—111) Adaptable prognosis models for district heating systems.** Sejling, K. (Technical Univ. of Denmark, Lyngby. Inst. of Mathematical and Operations Research). 1987. 205p. (In Danish). NTIS (US Sales Only), PC A10/MF A01. Order Number DE88755792/JAW.

The aim was to draw up and utilize a prognosis model that could be used to forward operational optimization of a district heating system. It was important to minimize the loss of heat produc-

tion and distribution, while at the same time ensuring that consumers continually received the necessary amount of heat. The combined power and district heating system which was examined in Esbjerg, the available data, and the methods used for identification, estimation and control of the models presented, are described. An identification of models used for rechsning heat consumption in followed by a comparative evaluation of various methods by which the estimations can be made adaptable. One of the methods is used to study the models formerly identified to ascertain whether they are suitable for online use. A comparison of two methods where the aim is to ensure that estimations will not be heavily influenced by mistakes in data caused by operational breakdown, is carried out. Finally models are studied in the light of supply-pipe temperature at a certain position in the system and simple method of prediction that can be used to control supply-pipe temperature is suggested. It was found that heat consumption could be predicted for 1,3,6 and 12 hours ahead within the following fault margins: 1 hour 2.94 MJ/S; 3 hour 5.84 MJ/S; 6 hour 8.66 MJ/S; 12 hour 11.62 MJ/S. In addition to the autoregressive aspect, the power stations supply-pipe temperature, the outside temperature and wind speeds are included in the model as influencing variables. There are different profiles for weekdays and weekend days. 20 refs. (AB).

11288 **(NEI-DK—120) West German market for district heating. Export models, primarily in relation to consultant and entrepreneur output.** *DK/881055C. (Ramboell og Hannemann, Raadgivende Ingenioerer A/S, Odense (Denmark); Roerbyg Koebenhavn A/S (Denmark); Skandinavisk Industriservice A/S, Ringsted (Denmark)). Aug 1988. 176p. (In Danish). NTIS (US Sales Only), PC A09/MF A01. Order Number DE88755801/JAW.

A detailed survey of Western Germany's energy situation and policy, especially in regard to district heating and the possibilities of Danish export of district heating components to that country. It is reckoned that Western Germany's energy policy will undergo a radical change in the near future, and that the government will offer increasing support to renewable energy initiatives which would be of advantage to the development of district heating projects. Four models are offered for Danish cooperation with West German organizations to promote the development of the market for Danish district heating components in Western Germany. 57 refs. (AB).

11289 **(PB—89-118418/XAB) Shear shredder demonstration. Volume 1, Final report; and Volume 2, Appendices.** (WTE Corp., Bedford, MA (USA)). May 1987. 355p. NTIS, PC A16/MF A01.

In this project, a shear shredder was demonstrated at an MSW-processing facility in Elmira, New York. The Elmira facility operated with two 800-hp hammermills, one of which was replaced with a 400-hp shear shredder. Since the shear shredder is half the height and weight of the hammermill it replaced, installation costs are considerably less. Power requirements were 30% less than the hammermill, while processing equivalent amounts of MSW. Results from these tests indicate that: feed rates for the shear shredder are comparable with the hammermill; discharge materials are coarser, allowing glass and other inerts to be easily removed; maintenance costs were substantially less for the shear shredder; and low-speed operations reduced the chance of metals in the MSW creating sparks that could cause fires or explosions. However, the finer discharge material produced by the hammermill is more desirable for combustion purposes.

11290 **(SHT—7902) Use of rubber asphalt binder with graded aggregate for seal coats.** (Saskatchewan Highways and Transportation, Regina (Canada)). 1979. 59p. (CE—02227). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

It has been known that incorporating rubber particles into asphalt can improve highway pavement performance. This paper describes a test program on pavement construction using asphalts containing recycled rubber. During the summer 1978, eight test sections were constructed in parts of the Saskatchewan road system to evaluate seal coats using rubber-asphalt as a binder membrane and a graded aggregate as protective cover. Test sections were chosen to represent typical road surface types and different states of repair for each type. These types included prime subgrade, cold-mix on subgrade, primed granular base course, asphaltic concrete on granular base, and full depth asphaltic concrete. Problems with construction materials, techniques, and equipment are discussed. Performance and economics were evaluated to determine whether low cost cold mix and current seal coat surfaces could be replaced successfully and economically by this method of construction. It was shown that use of reclaimed rubber for rubberized asphalt seal coats on Saskatechewan highways is a practical construction application. The economic justification for rubber asphalt seals will be determined after a full assessment of performance. Initial indications are that Saskatchewan graded aggregates are a suitable cover material for the rubberized asphalt membranes used in the trials. 8 refs., 16 figs., 7 tabs.

11291 **(STF—11A88042) Control, regulation, and monitoring of heat pumps equipped district heating systems.** Aaroeen, A. (Selskapet for Industriell og Teknisk Forskning, Trondheim (Norway)). Aug 1988. 10p. (In Norwegian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88755892/JAW.

The report deals with a project on the various methods to be used to improve the control, regulation, and monitoring of heat pump equipped district heating systems. The aim of the project is to obtain cost beneficial conditions and systems. 1 figure.

11292 **(STF—11A88043) Contribution to the IEA catalogue "A district heating catalogue of advanced production technologies".** Bang, R.; Haukaas, H.T.; Neksaa, P.; Aaroeen, A. (Selskapet for Industriell og Teknisk Forskning, Trondheim (Norway)). Aug 1988. 32p. (In English). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755893/JAW.

The report consists of four articles covering the following aspects: Advanced control and monitoring systems for a heat pump energy central; heat pump energy central designed for cold or contaminated water; large electric heat pump system with distribution at intermediate temperature; heat pump energy central for district heating/cooling system. 10 figures.

11293 **(SVF—299) Burning sod peat and woodchips in identical installations. Comparative evaluation at Vaggeryds Vaermeverk AB.** Appelberg, P.E.; Hecktor, B.O. (Vaggeryds Vaermeverk AB (SE); Hoegskolan i Kalmar (SE)). (Stiftelsen foer Vaermeteknisk Forskning, Stockholm (Sweden)). Mar 1988. 74p. (In Swedish). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88755920/JAW.

The community of Vaggeryd produces and distributes district heating in two built-up areas. The energy is produced in two identical heating plants, mainly by using domestic solid fuel such as peat and woodchips. Each of the boilers for solid fuel has a capacity of 2.5 MW and the solid fuel is fired on movable grids. The result of the study was that firing with sod peat was preferable from the technical as well as the economic point of view in these two plants. At an energy production of 9000 MWh/year the annual difference in costs was about 350 000 SEK. Some of the essential differences can be accounted for as follows. Flue gas temperature when firing peat was almost constant during the test period without cleaning the boiler. Flue gas temperature when firing woodchips rose by 120-150 degrees C in three days. It was necessary to clean the boiler twice a week. Thermal efficiency was about 8-9% higher with peat compared with chips. Of the total heat demand it was possible to produce 97% with peat. When firing chips the corresponding figure was 89%. The emission of nitrogen oxides when firing peat was about double that of the emission from chips. The problems with fuel- and ash handling systems were more frequent when burning chips but on the other hand the wear and tear was higher when burning peat. (authors).

3209 Education And Public Relations

REFER ALSO TO CITATION(S) 10883

11294 **(CRC—1987) A study of the Canadian public's attitudes toward the energy situation in Canada. Wave 4. A quantitative trend study conducted in selected major urban centres in Canada, of the attitudes of both men and women toward the subject of energy.** (Centre de Recherches Contemporaines Ltd., Montreal, Quebec (Canada)). 1978. 195p. (CE—02133). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

This report presents the results of a yearly study designed to examine the attitudes of the Canadian public to certain energy-related issues. The study attempts to measure: the extent to which Canadians regard energy as a problem, relative to other issues such as unemployment and inflation; the extent and manner in which the public can help alleviate the problem; the role governments should play in solving the energy problem; perceived benefits and effects of turning to new energy sources; and shifts in opinions from earlier studies. A new section, not included in previous surveys, covers the extent of readership of government publications on energy conservation. Data were collected based on telephone interviews with respondents in seven cities across Canada. A selection of what is considered to be meaningful and pertinent data is presented, and some data from earlier surveys are also included. A supplement to this report includes summary tables and copies of the questionnaires used in the surveys. 49 tabs.

33 ADVANCED AUTOMOTIVE PROPULSION SYSTEMS

3301 Internal Combustion Engines

REFER ALSO TO CITATION(S) 10674

11295 **(CONF-8305320—1) Exhaust gas turbocharged submarine engines.** Jost, V.M.W. (Motoren- und Turbinen-Union G.m.b.H., Friedrichshafen (Germany, F.R.)). 1984. 20p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE89770194/JAW.

From RINA international symposium on naval submarines; London, UK (1 May 1983).

Supercharged submarine propulsion systems have the following technical and econoic advantages: Higher power density, lower fuel consumption, maximum identity with standard propulsion systems. The design and successful tests of a new supercharger (simple radial turbines and radial compressor wheels cast in a single piece) are reported. Submarine propulsion systems of a special line are briefly described, and the experimental programme, test bench facilities, findings (submerged state and surface travelling), and specific fuel consumption are gone into. Supercharged diesel engines are found to perform well under the high specific intake pressures and counterpressures that are specific to submarine operation. (HWJ).

11296 **(DOE/AL/17085—T3) Diesel fuel sprays: Final technical report.** Durrett, R.P.; Ferguson, C.R.; DeWitt, D.P. (Purdue Univ., Lafayette, IN (USA). School of Mechanical Engineering). 31 Aug 1988. Contract AS04-81AL17085. 53p. NTIS, PC A04/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005104/JAW.

This report briefly reviews our accomplishments during the entire tenure of our contract. A detailed review is not warranted, because with one exception, the results have been published in the open literature. The one exception is our study of supercritical transient atomization performed in this, the last year of our contract. Hence, those results are presented in detail, and make up the bulk of our report. Our main goal was to provide a data set with sufficient detail that it could be used to validate a multidimensional model of combustion in a diesel engine. Realization of that goal brings this program to a logical conclusion. The resultant data set is described in the two part paper written by Durrett et al. (1987) and by Oren et al. (1987). Accomplishment of that goal required completion of a number of subsidiary tasks, each of which yielded important results of their own. A diesel combustion bomb was developed to provide a means of simulating diesel combustion and yet allow for complete optical access, Oren et al. (1984). At the program's onset a philosophy was adopted that recognized that combustion in the bomb may differ from that in an engine. 27 refs., 18 figs., 3 tabs.

11297 **(DOE/AL/33183—T10) Multidimensional modeling of convective heat transfer with application to IC engines: Technical progress report.** Jennings, M.J.; Morel, T. (Integral Technologies, Inc., Westmont, IL (USA)). 6 Jan 1989. Contract AC04-86AL33183. 24p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005311/JAW.

The objective of this project is to develop a more comprehensive understanding of the convective heat transfer process in complex, unsteady turbulent reacting flows, typical of those which occur in internal combustion engines. The specific area of research is the representation of heat transfer in detailed multi-dimensional Navier-Stokes models, and modeling of turbulent transport mechanisms. The detailed tasks include a review of relevant prior work. Based on this review, and original work done under this contract, several modeling approaches will be formulated and further studied and tested. The tests will be carried out on flow cases which have relevance to engine flows, and for which reliable experimental data exist. Such data will be sought and identified. The analytical studies will lead to the determination of the best modeling approaches to be used for heat transfer simulation in internal combustion engines. Following that, a detailed study will be carried out of spatial and temporal heat flux distribution in a representative engine. This will be complemented by a parametric study of engine heat transfer dependence on intake flow details, combustion chamber geometry, engine speed and engine load. 3 refs., 12 figs.

11298 **(TKK-KO/PM—52) Combustion studies with a spark-assisted single-cylinder diesel engine using ethanol direct injection.** Vauhkonen, J.-P.; Pitkaenen, J. (Helsinki Univ. of Technology, Otaniemi (Finland). Internal Combustion Engine Lab.). (Helsinki Univ. of Technology, Otaniemi (Finland)). 1988. 44p. (In Finnish). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755924/JAW.

This report describes the results of tests carried out on a high speed diesel engine equipped with a electrical spark ignition system and using ethanol as fuel. The work is part of a research programme called /sup A/lcohol diesel engines/sup ./ In the final stage of the alcohol fuel research programme, a single cylinder version of Valmet 311CS diesel engine with direct injection was furnished with an electrical spark ignition system. In this application the spark induced by the spark plug ignites the alcohol fuel injected into the unchanged combustion chamber of the basic engine. The test engine was of course naturally aspirating. The engine does not operate without the fuel-air ratio regulation. Intake air throttling was taken as chouce for the mixture control.

3302 External Combustion Engines

11299 **Mod II Stirling engine overviews.** Farrell, R.A. Latham, NY; Mechanical Technology, Inc. (1988). 14p. (CONF-880241—).

From Society of Automotive Engineers international congress and exposition; Detroit, MI, USA (29 Feb 1988).

The Mod II engine is a second-generation automotive Stirling engine (ASE) optimized for part-power operation. It has been designed specifically to meet the fuel economy and exhaust emissions objectives of the ASE development program. The design, test experience, performance, and comparison of data to analytical performance estimates of the Mod II engine to date are reviewed. Estimates of Mod II performance in its final configuration are also given. 12 references.

3303 Electric-powered Systems

REFER ALSO TO CITATION(S) 11147, 11153

3304 Hybrid Systems

REFER ALSO TO CITATION(S) 11147

3306 Vehicle Design Factors

11300 **(STU—87-1735) Preliminary study of Otto engines for propulsion of buses.** Pettersson, H.Aa. (Thoreb AB, Goeteborg (SE)). (Swedish National Board for Technical Development, Stockholm). 1 Nov 1987. 49p. (In Swedish). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755903/JAW.

The consequences of using catalytic converter equipped gasoline engines in city buses are examined in this report. The main alternative suggested is to use two private car engines as replacement for the diesel engine. The performance of the twin engine bus will be approximately the save as that of the diesel bus. The fuel consumption will increase by 40 per cent, the air pollution emissions will be heavily reduced for particles and nitrogen oxides. Noise and vibrations will also be reduced. The otto engine alternative will be of advantage in the event of conversion to alternative fuels. (L.E.).

11301 **(VTT-TUTK—497) Development of research methods for the cold-use of engines in labortory conditions.** Nylund, N.O. (Secretaria de Asentamientos Humanos y Obras Publicas, Mexico City (Mexico)). (Valtion Teknillinen Tutkimuskeskus, Espoo (Finland)). Aug 1987. 165p. (In Finnish). NTIS (US Sales Only), PC A08/MF A01. Order Number DE88755932/JAW.

The energy consumption and wear of cars and machines is increased considerably in cold conditions. The Technical Research Centre of Finland has made a sizeable contribution to cold research. The major aim is to increase efficiency and to reduce wear in engine operation at low temperatures. The performance of the cold research equipment and results of the first test series with engines are presented. One of the main tasks was to develop cold condition laboratory test methods. The essential components of the cold research equipment are a cold room equipped with an efficient cold machinery and a processor-controlled engine dynamometer located outside the cold room. Engine tests under load can be carried out to about -35 deg C. Tests were performed on a conventional gasoline passenger car engine and on a direct injection diesel engine used in farm tractors. The test temperatures were +20,0,-10,-20, -25, and -30 deg C. The test period was 30 minutes. The engines were run both under constant load and cyclic load. Startability, lubrication, warming up, fuel consumption, and exhaust gas emissions were monitored. In addition to test temperature, other variables were for example, the quality of engine oil and the use of auxiliary heaters. The fuel consumption increased by 10-15% in both engines, when the test temperature was lowered from +20 to -30 deg C. The saving gained by the use of the block heater was on average 5%. The quality of engine oil had no significant effect on the fuel consumption of the engines. Both the temperature and the quality of engine oil had a strong effect on the start of lubrication in different parts of the engine.

3307 Emission Control

REFER ALSO TO CITATION(S) 10674, 11257

11302 **(IVL-B—853) Gas detectors for diesel engines exhaust. Results of a short term evaluation study of four commercial instruments for use in indoor occupational health surveys.** Werner, J. (Swedish Environmental Research Inst., Stockholm). Mar 1987. 41p. (In Swedish). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755771/JAW.

We examined four instruments: SEMA which uses a semiconducting sensor and Ecolyser 5003, Gastec ND-2D and Interscan 4000 which use electrochemical detection systems. Measurements were carried out over periods of 1 to 12 hours and concentrations of NO/sub 2/ were in the range 0-0.35 ppm controlled by an instrument based on chemiluminiscence. We examined the effect of temperature, relative humidity, carbon monoxide and sulphur dioxide. Diesel and petrol engine exhaust were injected at the dilution level from 1:50 to 1:3000. Carbon monoxide and to a lesser extent humidity interfered when using the SEMA instrument. Also a long response time made us judge this instrument as unsuitable for applications in the working environment. All the electrochemical instruments gave values close to those of the control instrument. Zero drift over a period of 24 hours was less than 0.1 ppm at room temperature. Changes in the temperature from 40 to 3 degrees C produced a change in the baseline 0.3 ppm. The response time at all temperature levels was less than 1 min at the 100 percent level. Only low levels of interference were encountered even with high concentrations of petrol engine exhausts. Only minor differences were encountered among the three instruments thus showing rather promising results for the task.

11303 **(PB—89-118475/XAB) Motor vehicle emissions under reduced ambient-temperature idle-operating conditions (journal version).** Baugh, J.; Ray, W.; Black, F. (Environmental Protection Agency, Research Triangle Park, NC (USA). Atmospheric Sciences Research Lab.). 1987. 9p. (EPA—600/J-87/445). NTIS, PC A02/MF A01.

Pub. in Atmospheric Environment, Vol. 21, No. 10, 2077-2082(1987).

Gasoline motor-vehicle organic emissions are elevated by reduced-ambient-temperature operating conditions, and the practice of warming vehicles with extended idle periods, as is common during winter months. Total hydrocarbon, carbon monoxide, nitrogen oxides, and formaldehyde emissions are examined under idle operation at 20 F, 40 F, and 68 F with six gasoline-fueled vehicles (including noncatalyst, early catalyst, and late-model catalyst) and a methanol-fueled prototype vehicle. The emissions were substantially reduced by the late-model catalyst control technologies at all temperatures examined. Formaldehyde emissions were elevated with methanol fuel.

11304 **(SNV—3452) Procedures for automobile exhaust gas control. Functioning and limit values.** Egebaeck, K.E. (Statens Naturvaardsverk, Nykoeping (SE). Bilavgaslab. i Studsvik). (National Swedish Environmental Protection Board, Solna). 1988. 210p. (In Swedish). NTIS (US Sales Only), PC A10/MF A01. Order Number DE88755864/JAW.

Catalytic exhaust gas purification technique demands a more stringent control system than the earlier technique did. To guarantee a good purification result for the long operating time of today's cars, it is necessary that they are subjected to continuous inspection and maintenance. The report presents results of testing of two short-test procedures: UBA/TUEV-test and INCOLL-test. 6 automobiles of 5 different makes were tested. Both procedures showed a relatively good ability to identify cars with too large emissions. Specific limit values for each engine family are needed to attain decreased emissions from automobiles in traffic and full effect of control measures. (O.S.).

3308 Alternative Fuels

REFER ALSO TO CITATION(S) 10674, 10842, 10865, 11298

11305 (BEI—1980, pp 7) **Emulsified alcohol/petroleum fuels - tests to date.** Lawson, A. (Ontario Research Foundation). 1980. CANMET/TIC, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada. (CONF-8006185—; CE—02121).

From Canadian national power alcohol conference; Winnipeg, Canada (20 Jun 1980).

With diesel fuel availability becoming increasingly of concern, the opportunity exists for employing alcohol as a diesel fuel extender. This paper describes the development of a fuel emulsification technique to fuel diesel engines with unstabilised alcohol/diesel emulsions. The key to the approach lies in the application of a me-

chanical fuel emulsification device (the HydroShear) which is compatible with installation in the fuel line of diesel engines. Alcohol and diesel fuel are fed from two tanks to the HydroShear, and the resultant fuel emulsion possesses sufficient stability to be supplied to the fuel injectors for combustion. Engine dynamometer testing has shown that a heavy duty truck engine (Detroit Diesel 8V71N) can be operated on up to 25% methanol/diesel emulsion, and up to 35% ethanol diesel emulsion. Engine efficiency increases with alcohol content, smoke is reduced, but NO/sub x/ emissions increase. This two-tank concept allows the engine to be started on diesel fuel, operated on alcohol/diesel emulsions or diesel fuel, and stopped on diesel fuel. No retuning of the engine is required, and the water content of the alcohol is unimportant. Further development of this system has led to an on-board system being installed on a heavy duty GMC Brigadier Truck. This demonstration vehicle is fully instrumented to provide highway fuel consumption data, and is presently undergoing chassis dynamometer testing and road trials fueled with methanol/diesel emulsions. 7 refs., 7 figs., 2 tabs.

11306 (BEI—1980, pp 18) **Methanol and ethanol as fuel for spark ignition and diesel engines.** Adelman, H.G. (Univ. of Santa Clara, California, USA). 1980. (CONF-8006185—; CE—02121).

From Canadian national power alcohol conference; Winnipeg, Canada (20 Jun 1980).

Methanol and ethanol operation of spark ignition or diesel engines requires more fuel per unit of air than gasoline; thus, modifications to fuel metering are required for best engine performance. The high vaporization heat of alcohols results in possible starting problems at low temperatures and possible fuel condensation. Alcohols also have phase separation problems when used in hydrocarbon fuel blends. A positive factor for alcohols is their higher octane rating, which enables development of high-compression, high efficiency engines. Alcohols can be destructive to some engine materials, so alcohol resistance must be considered in engine design. Performance of pure alcohol fuelled vehicles shows high thermal efficiency and power output. Driveability is comparable to gasoline vehicles, except possibly during warmup. For gasohol-powered vehicles, energy efficiency does not appear to be improved significantly by blend operation under the same conditions as gasoline, but efficiencies could be increased by taking advantage of the blends' higher octane value. Exhaust emissions for alcohols and blends are shown to be similar to, or lower than, those for gasolines, depending on the emission component. In diesel engines, problems with using pure alcohols are mainly due to lower fuel/air ratios and the higher vaporization heat; overcoming these problems requires modifications of the fuel injection system, and providing heat to vaporize fuel properly. Alcohol-diesel blends present problems with mutual solubility, flame ignition, and low lubricity. These can be overcome to a certain extent by using additives, emulsifying the fuel, installing dual injection systems or using spark ignition. 36 refs.

11307 (BEI—1980, pp 12) **A survey of proposed methods of burning alcohol in diesel engines.** Foster, D.E. (Univ. of Wisconsin, Madison). 1980. (CONF-8006185—; CE—02121).

From Canadian national power alcohol conference; Winnipeg, Canada (20 Jun 1980).

A number of different methods of burning alcohol in diesel engines are discussed. The main difficulty is initiation of the flame; one approach is to improve alcohol's cetane number by chemical additives. The main drawback to this is the availability and cost of cetane improvers. Another alternative is to convert the engine into a spark-ignited engine, but this method is not well suited to retrofitting. A similar possibility, the surface-ignited engine, has not been shown to actually work. Another ignition method would be to provide for a pilot injection of diesel fuel; this would require a special engine head with two injectors, and would thus be expensive. To avoid the extra injector system, the alcohol could be introduced into the cylinder as a lean fuel-air mixture, and would be ignited by use of diesel fuel injected directly into the cylinder. This concept, called fumigation, has been investigated by several researchers; one kind of conversion involves installing a carburetor, with disadvantages similar to spark engine conversion, and the other involves injecting an alcohol-water mix into the intake manifold of a turbocharged engine. In both cases, substitution of diesel fuel is no more than 50%. Another alternative is to use diesel-alcohol mixtures; the two fuels do not mix well, especially if water is present. This can be overcome by emulsifying the fuel, but the amount of alcohol used is limited to 20-30% and the use of such emulsified fuels is currently best suited to steady-state, full-load conditions. It is concluded that fumigation and emulsification are currently the two most feasible methods for adapting diesel engines to burn alcohol. 12 refs., 2 figs, 1 tab.

11308 (BEI—1980, pp 11) **The conversion of existing engines to run on alcohol fuel.** Kirk, M. (Ontatio Ministry of Agriculture and Food, North Bay). 1980. CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada. (CONF-8006185—; CE—02121).

From Canadian national power alcohol conference; Winnipeg, Canada (20 Jun 1980).

Internal combustion engines can be run unmodified, using fuel blends containing up to 20% alcohol; technical advantages are small, and problems may occur if water is present in the fuel. Significant advantages can be obtained by converting engines to straight alcohol consumption. Technical considerations in such conversions must take into account the energy content of the fuel and the engine's thermal efficiency, the higher heat of vaporization of alcohol, the octane number, the poor lubrication quality of alcohol, the fuel's water content, and corrosion problems. Conversions can be done on several levels of complexity. A simple primitive conversion, which does not change the compression ratio, requires replacing plastic parts with more resistant materials, enlarging the carburetor jet, and providing heat energy to the fuel. This modified engine will deliver about the same power as when using gasoline, with a volumetric fuel consumption 150% greater using ethanol and 200% greater using methanol. An improved primitive conversion uses high compression but retains the cold starting features of external carburetion. Power available will be ca 10% greater than from a gasoline engine of the same size, and volumetric fuel consumption will be 120% greater using ethanol. The Brandt system uses high compression and internal carburation. Such sophisticated conversions are capable of achieving the same volumetric fuel consumption as gasoline engines of similar size, giving greater power, lower engine temperature, and no soot or carbon formation. 21 refs.

11309 **(SNV—3302) Has diesel fuel composition an effect on emission ?.** Bjoerkman, E.; Egebaeck, K.E. (National Swedish Environmental Protection Board, Solna). Apr 1987. 33p. (In Swedish). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755856/JAW.

Three varieties of diesel fuels - trade quality diesel, light diesel, and a high percent aromatics diesel - was tested in two heavy vehicles, Volvo TDF 100 and Scania DS 1125. The vehicles were tested on a chassis dynamometer according to USA transient cycle. Measurements were done of regulated and unregulated impurities. Also mutagenesis of the exhaust gases was measured. Three samples were taken to increase the data reliability. From the analysis is concluded: - By using high percent aromatics diesel fuel, the discharge of regulated impurities was increased by 5-35% in comparison with trade quality diesel fuel, - By using light diesel fuel the particle discharge was decreased by 20% in comparison with trade quality diesel fuel, - By using light diesel fuel, the discharge of PAH and the mutagenesis of the exhaust gases decreased in comparison with trade quality diesel fuel and high percent aromatics diesel fuel. The difference of the different vehicles appeared i.a. in the carbon monoxide discharge being higher for the Volvo truck than for the Scania, and in the Volvo truck discharging more polyaromatic compounds. On the other hand mutagenesis data were roughly equal. Also four other cycles were tested, without repeating the sampling. The tendencies gathered from these tests are higher carbon monoxide discharges of the Volvo truck in comparison with the Scania. This also holds for the nitrogen oxide discharge during the transient cycles. (O.S.).

11310 **(SNV—3303) Is liquefied petroleum gas compatible with environment ?.** Graegg, K.; Egebaeck, K.E. (National Swedish Environmental Protection Board, Solna). Mar 1987. 30p. (In Swedish). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755857/JAW.

Two LPG propelled buses, one Scania CR 112 with suction engine and one turbocharged Volvo P10M without charge air

cooler, were investigated. The emission patterns of the vehicles tested are quite different in some respects, probably because of differing engine design. The nitrogen oxides discharge of the Scania bus is about three times higher than those of the Volvo bus. In addition, emissions of polycyclic aromatic hydrocarbons and mutagenesis are higher for the Scania bus. Both buses have large emissions of hydrocarbons due to FID-analysis in comparison with diesel propulsion. There might be a potential for environmental improvement by gas propulsion. The discharge of particles and some other impurities strongly decrease and also the mutagenesis. These statements imply that the gas unit works well, is optimized for low emissions of impurities, and has a firm adjusting. (O.S.).

11311 **(STU-I—640-1987) Project M100 - A test with methanol-fueled vehicles in Sweden.** Brandberg, Aa.; Hedbom, A.; Isaksson, K.; Laveskog, A. (Swedish Motor Fuel Technology Company, Stockholm (SE)). (Swedish National Board for Technical Development, Stockholm). Dec 1987. 142p. NTIS (US Sales Only), PC A07/MF A01. Order Number DE88755907/JAW.

The present report documents the results of an over two-year long field test under Swedish conditions with methanol-driven automobiles with Otto-engines. The project is part of a plan drawn up in 1982 for the development of alternative fuels as part of national energy policy. The project has been implemented in collaboration with Swedish and other automobile manufacturers and oil companies. The field test has been preceded by studies and practical testing of methanol-driven automobiles within the development of methanol-fueled motor prototypes at Saab-Scania and Volvo Passenger Cars. The report is essentially a documentation of results and experiences in analyzed and abridged form and combined with examples taken from the detailed base material. This base material is documented in the appendices whose dissemination is limited to the sponsors and manufacturers. The results are documented according to the subfields; vehicular operation and maintenance, registration of driving patterns, fuel distribution, monitoring motor oil, and method development of systems for monitoring operating conditions. The external circumstances of severe winters in 84/85 and 85/86 have been favourable in terms of inducing critical conditions for methanol drive, namely, start-up and driving under conditions of (extreme) cold. The aim of the field test, i e to gain experience from these conditions have been fulfilled. (authors).

11312 **(SV-US—1988-11) Natural gas vehicles. Technology, economy and environment.** Svensson, B. (Swedish State Power Board, Vaellingby). Feb 1988. 116p. (In Swedish). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88755916/JAW.

The purpose of this report is to give an overview of the situation today and tendencies for the future concerning the use of natural gas as a fuel for vehicles, in Sweden and internationally. The following main subjects are being discussed. The international situation regarding the size of the market, the main reasons for the existence of a market and predicted future developments. Motives for making a conversion to natural gas fuel. Different types of vehicles and vehicle-owner categories are considered. The technology is described both with regards to distributing the natural gas and the necessary modifications of the vehicles. For the vehicles a state of the art summary is made concerning the engines and tank-systems, and possible future improvements and developments are discussed. A special interest is given to natural gas fuel as a means of reaching low exhaust gas emissions. A presentation is made of a number of planned Swedish R and D projects mainly focused on the use of natural gas for citybuses, and of different international organizations which are active in this field of technical development today. A final conclusion is that the main reason for a possible introduction of NGV technology in Sweden will be the potential to reduce emission levels from heavy vehicles, especially in crowded areas.

35 ARMS CONTROL

3503 Verification

REFER ALSO TO CITATION(S) 11699

11313 **(LA—11475-MS) Interpretations: Understanding Soviet arms control motivations and verification attitudes.** Gere, S.B. (Los Alamos National Lab., NM (USA)). Dec 1988. Contract W-7405-ENG-36. 29p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005295/JAW.

The root motivation at the heart of present Soviet arms control motivations and verification attitudes is grounded within the broad historical perspective of the Russian and Soviet mobilization struggle. It is from this perspective that present Soviet behavior is rooted. Our understanding of this root motivation is essential to identifying opportunities to enhance US-Soviet relations and in turn our national security. 33 refs.

36 MATERIALS

3601 Metals And Alloys

REFER ALSO TO CITATION(S) 10622, 10751, 10751, 10811, 10956, 10984, 10991, 10991, 11015, 11015, 11016, 11127, 11441, 11487, 11503, 11548, 11558, 11559, 11586, 11586, 11586, 11600, 12307, 12333, 12336, 12337, 12341, 12348, 12352, 12356, 12368

11314 **(AD-A—198359/2/XAB) Mean-stress dependence of the thermoelastic parameter for three high-strength alloys. Aircraft structures report.** Dunn, S.A.; Wong, A.K.; Sparrow, J.G. (Aeronautical Research Labs., Melbourne (Australia)). Jul 1988. 22p. (ARL-STRUC-R—433). NTIS, PC A03/MF A01.

Experimental verification for the theoretical basis of the mean stress dependence of the thermoelastic parameter is presented here for 4340 steel and collated with previous results for 2024 aluminum and 6 Al-4V titanium alloys. Various experimental techniques are described and their relationship with the theory is discussed in detail. Finally, the means by which the thermoelastic effect may be used to determine residual stresses in practice is discussed.

11315 **(CEA-CONF—9381) Review of electron beam and laser process use in the nuclear area.** Contre, M. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Technologie). 1987. 20p. (In French). (CONF-8711270—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756213/JAW.

From Meeting on the laser VS the electron beam in welding cutting and surface treatment; Reno, NV, USA (1 Nov 1987).

New techniques such as electron beam and laser can find applications for components realization, fuel fabrication, waste processing, maintenance and dismantling because of beam specifity and performance expected. In welding low deformation is the decisive factor for the choice of the process leading to use electron beam and laser for some applications. In dismantling the low waste amount produced by laser cutting and possibilities of automation allow to forecast a wide development of the process. Significant examples are given and a prospective review of future possibilities from present development are presented. 36 refs.

11316 **(CEA-CONF—9573) Mechanical characteristics of a very low carbon nitrogen controlled austenitic stainless steel 17-12 for the determination of permissible stress.** Escaravage, C. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (FR). Dept. de Technologie; Electricite de France, 77 - Ecuelles (FR); NOVATOME, 69 - Lyon (FR)). (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Technologie). 1988. 9p. (In French). (CONF-8805244—).

From 27. meeting on special steels; Saint-Etienne, France (26 May 1988).

The steel studied is of the type Z2CND17-12 used for some components of the fast reactor Super Phenix. It is a molybdenum steel with carbon content limited to 0.030 %, to reduce intergranular corrosion, nitrogen content is controlled to improve mechanical behavior. For the determination of maximum permissible stress mechanical characteristics are regrouped in a data base and relationships are formulated to give tensile properties and creep in function of temperature for sizing and safety.

11317 **(CEA-CONF—9581) Parametric study for characterization of beam-matter interaction.** Richard, A.; Charissoux, C.; Calvet, J.N.; Contre, M. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Technologie). 1988. 12p. (In French). (CONF-880922—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756226/JAW.

From 4. international symposium on welding and melting by electron and laser beams; Cannes, France (26 Sep 1988).

The requirements of the use of surface thermal treatment by laser (quenching for example) and the operation control involve a perfect knowledge of the specific action of each parameter. The characteristics and the thickness of the transformed metal are indeed, very directly related to the material and beam characteristics. A parametric study was made in this way on two alloys: zircaloy and TA6V. It has led to the setting up of an empiric formulation relating closely quenching penetration and test conditions. The application of this approach for the continuous surface treatment was examined through the analysis of the problems connected to the pass overlapping and the associated thermal cycles.

11318 **(CONF-8804232—1) Anomalous slip in an FCC system.** Lee, T.C.; Robertson, I.M.; Birnbaum, H.K. (Illinois Univ., Urbana (USA). Dept. of Materials Science and Engineering). 1988. Contract AC02-76ER01198. 13p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89002257/JAW.

From Conference on frontiers of electron microscopy; Chicago, IL, USA (1 Apr 1988).

During in-situ TEM deformation of 310 stainless steel, it has been observed that a/2<110> dislocations are glissile on the {121} planes as well as on the more common {111} planes. The {121} slip plane was initiated by a grain-boundary dislocation source to relieve the stress concentrated on a grain boundary by a dislocation pile-up. This preference of slip on a (121) plane over a (111) plane can be understood by considering, in addition to the magnitude of the resolved shear stress on the plane, the angle between the lines of intersection of the slip systems in the boundary plane and the magnitude of the residual dislocation left in the grain boundary by the emission process. 7 refs., 2 figs., 2 tabs.

11319 **(CONF-8809190—1) Oxidation of Ni_3Al below 850{degree}C and its effect on fracture behavior.** DeVan, J.H.; Hippsley, C.A. (Oak Ridge National Lab., TN (USA); UKAEA Harwell Lab.). 1988. Contract AC05-84OR21400. 14p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89002232/JAW.

From Workshop on the oxidation of high-temperature intermetallics; Cleveland, OH, USA (20 Sep 1988).

Studies were conducted to establish the oxidation kinetics and reaction products associated with exposure of Ni_3Al to air at intermediate temperatures. A significant finding was the susceptibility of Ni_3Al to internal oxidation at 600 to 825{degree}C. Since oxygen embrittlement of Ni_3Al is observed in the same temperature range, crack growth studies were subsequently conducted to examine a possible connection between the embrittlement and internal oxidation processes. Chemical analyses of the near-crack-tip region showed a periodicity in surface oxidation products symptomatic of a stepwise crack propagation process. A kinetic model is proposed in which oxygen diffuses along the grain boundary in front of a stationary crack tip until a critical oxygen inventory is achieved. The crack jumps forward by a small increment ({approximately}0.5 μm), and the process repeats. Surface analytical chemistry results and an Arrhenius analysis of crack rate vs temperature are presented as evidence for the proposed cracking model. 10 refs., 7 figs.

11320 **(CONF-8809202—1) Fuel constituent redistribution during the early stages of U-Pu-Zr irradiation.** Porter, D.L.; Lahm, C.E.; Pahl, R.G. (Argonne National Lab., Idaho Falls, ID (USA)). 1988. Contract W-31109-ENG-38. 29p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89003629/JAW.

From Symposium on irradiation-enhanced materials science; Chicago, IL, USA (25 Sep 1988).

Irradiation and fission-related phenomena in metallic fuels based on the U-Pu-Zr system result in fuel restructuring in the forms of fuel swelling (Xe/Kr bubble growth) and constituent redistribution. An experiment designed to analyze the early development of these phenomena and the correlative behavior between them has recently been completed. Fuel porosity development was traced carefully as a function of fuel burnup. The results indicated that the porosity distributions would lead to significant changes in fuel operating temperature. Concurrent observations concerning composition redistribution indicated that the porosity development preceded significant constituent redistribution. The zirconium redistribution had been theorized to be related to the position of phase boundaries at specific locations within the thermal gradients existing in the fuel. The restructuring phenomena were analyzed in terms of how they may affect the existence of specific phases, and therefore atomic migration. 7 refs., 10 figs.

11321 **(CONF-8809215—1) Atomistic simulation of superdislocation dissociation in Ni_3Al.** Yoo, M.H.; Daw, M.S.; Baskes, M.I. (Oak Ridge National Lab., TN (USA); Sandia National Labs., Livermore, CA (USA)). 1988. Contract AC05-84OR21400;AC04-76DR00789. 8p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004805/JAW.

From Atomistic modelling in materials - beyond pair potentials; Chicago, IL, USA (27 Sep 1988).

The purpose of this paper is to determine the core structure of <101> screw superdislocations in Ni_3Al using the embedded atom method. First, the bulk properties and fault energies of Ni_3Al pertinent to superdislocations are discussed. Second, the initial and boundary conditions for the atomic cell are specified. Third, the calculated results of both spontaneous dissociations and stable equilibrium configurations are presented. Finally, discussion is given on the comparison of the present results with the two previous results. Including the effect of applied stress on dislocation mobility. 26 refs., 4 figs., 2 tabs.

11322 **(DOE/CE/15285—T1) Trials at Clemson University, SC of method for continuous casting of non-ferrous strips: Final report, June 28--August 6, 1987.** Palmer, F.M. (Palmer (Forrest M.), Hilton Head, SC (USA)). 16 Sep 1987. Contract FG01-86CE15285. 16p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004154/JAW.

This project was an attempt to prove a process using a metered flow of molten metal onto two counter-rotating drums, near their apexes, which when semi-solidified and carried over to the gap between the two drums would form a thin continuous strip. Such a strip could be fortified with filaments or whiskers to manufacture metal matrix composites at lowered cost. Preliminary work with lead had demonstrated that relatively simple equipment and procedures would produce strip on one drum with an adequate surface on the side contacting the drum. It was, therefore, expected that two drum casting could be used to produce strip with an adequate surface on both sides and that the process could be adapted for aluminum using the same equipment. The original plan had been to carry out the work in the foundry facility at Pennsylvania State University during 1986. However, various delays occurred, and when the sponsoring professor, Dr. Alan B. Draper, died, it was decided to move the project to Clemson University, SC, which had aluminum melting facilities, and to carry out the work during the summer of 1987. 4 figs.

11323 (DOE/ER/13865—8) Physical-chemical studies of transuranium elements: Progress report for the period April 1, 1988--March 31, 1989. Peterson, J.R. (Tennessee Univ., Knoxville (USA). Dept. of Chemistry). 1988. Contract FG05-88ER13865. 6p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004367/JAW.

This is a brief progress report of work performed under DOE contract AS05-76ERO4447 and DOE grant FG05-88ER13865 during the year ending March 31, 1989. The experimental work was carried out in the Transuranium Research Laboratory (TRL) of the Oak Ridge National Laboratory (ORNL) and in the European Institute for Transuranium Elements (EITU) in Karlsruhe, Federal Republic of Germany (FRG). Research involving the structural analysis of selected lanthanide tribromides under pressure was performed via angle-dispersive x-ray diffraction using a position-sensitive detector in the EITU. A new research initiative to identify a potentially new crystal structure of selected lanthanide tribromides under pressure via energy-dispersive x-ray diffraction analysis was also begun. 9 refs.

11324 (DOE/ID/12467—2) Physical chemistry of carbothermic reduction of alumina. Frank, R.A. (Massachusetts Inst. of Tech., Cambridge (USA)). Sep 1985. Contract FG07-83ID12467. 181p. NTIS, PC A09/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004713/JAW.

Production of aluminium, by means of carbothermic reduction of alumina, is discussed. By employing a solvent metal bath to absorb the alumina metal, carbothermic reduction of alumina was accomplished at temperatures 300{degree}C lower than the temperatures reported in the literature. Reduction occurred without the formation of intermediate compounds and without the high volatilization of aluminum bearing species. Reduction of alumina immersed in a solvent bath appeared to be rate limited by chemical reaction control. The rates seemed to be a function of the activity of aluminum in the solvent metal bath. Reduction of alumina particles, above the surface of the bath, seemed to occur via vapor transport with carbon in the particles or in the crucible walls. Mass transport in the gas phase appeared to be rate limiting. The rates seemed to be a function of the distance separating the alumina and carbon sources. With both submerged alumina and alumina particles, increasing the surface area of the alumina increased the rate of reduction. 58 refs., 65 figs., 9 tabs.

11325 (DOE/NE/37963—7) Quantitative measurement and modeling of sensitization development in stainless steels. Atteridge, D.G.; Wood, W.E.; Bruemmer, S.M. (Oregon Graduate Center, Beaverton (USA)). [1988]. Contract AC06-86NE37963. 282p. NTIS, PC A13/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004646/JAW.

The current state-of-the-art to quantitatively measure and model sensitization development in austenitic stainless steels is assessed and critically analyzed. A modeling capability is evolved and validated using a diverse experimental data base. Quantitative predictions are demonstrated for simple and complex thermal and thermomechanical treatments. Commercial stainless steel heats ranging from high-carbon Type 304 and 316 to low-carbon Type 304L and 316L have been examined including many heats which correspond to extra-low-carbon, nuclear-grade compositions. Within certain limits the electrochemical potentiokinetic reactivation (EPR) test was found to give accurate and reproducible measurements of the degree of sensitization (DOS) in Type 304 and 316 stainless steels. EPR test results are used to develop the quantitative data base and evolve/validate the quantitative modeling capability. This thesis represents a first step to evolve methods for the quantitative assessment of structural reliability in stainless steel components and weldments. Assessments will be based on component-specific information concerning material characteristics, fabrication history and service exposure. Methods will enable fabrication (e.g., welding and repair welding) procedures and material aging effects to be evaluated and ensure adequate cracking resistance during the service lifetime of reactor components. 146 refs., 84 figs., 6 tabs.

11326 (DOE/NE/37963—8) Deformation induced microstructural and microchemical changes during thermomechanical treatment: Quarterly progress report, April--June 1988. Bruemmer, S.M.; Atteridge, D.G.; Murr, L.E.; Wood, W.E. (Oregon Graduate Center, Beaverton (USA)). 1988. Contract AC06-86NE37963. 37p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004645/JAW.

This research program is divided into four tasks. Task I will investigate the development of grain boundary defect structure and precipitate nucleation as a function of material temperature and strain histories. Task II will investigate alloying element redistribution, impurity segregation and precipitate growth at grain boundaries as a function of material composition, and temperature and strain histories. Task III will characterize specific aspects of mill processing, shaping and shop and field fabrication practices used to produce commercial austenitic stainless steel and Alloy 600 components. Task IV will integrate individual program components including thermomechanical processing, grain boundary microstructure and microchemistry and susceptibility to intergranular cracking. Interrelationships among these components will be described analytically when feasible, and phenomenologically when necessary.

11327 (EGG-M—88053) Optical parameter effects on laser generated ultrasound for microstructure characterization. Telschow, K.L.; Conant, R.J. (EG and G Idaho, Inc., Idaho Falls (USA)). 1988. Contract AC07-76ID01570. 8p. (CONF-881081—2). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005193/JAW.

From Meeting on nondestructive characterization of materials; Saarbrucken, F.R. Germany (3 Oct 1988).

Under appropriate conditions a significant feature of the laser generated elastic waveform in the thermoelastic regime is a precursor (sharp spike) signaling the arrival of the longitudinal wave. This paper shows that the observed precursor can be understood through the use of one-dimensional models that account for optical penetration and thermal diffusion into the material. Experimental results are compared with a two-dimensional analytic calculation including optical penetration. 8 refs., 4 figs.

11328 (FRCEA-TH—155) Study of magnetic structure of neptunium compounds: Np As, Np Sb, Np Se et Np Ru/sub 2/ Si/sub 2/. Bonnisseau, D. (CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France). Dept. de Recherche Fondamentale; Grenoble-1 Univ., 38 (France)). Nov 1987. 203p. (In French). NTIS (US Sales Only), PC A10/MF A01. Order Number DE88756441/JAW.

Magnetic behavior and localization of 5f electrons in actinide compounds is studied experimentally by Moessbauer spectroscopy and neutron diffraction. Binary actinide compounds with a NaCl structure are examined and properties of U, Pu and Np monopnictides and monochalcogenides are recalled. Results of neutron diffraction by NpAs and NpSb are discussed and results of magnetic susceptibility, magnetization, Moessbauer spectroscopy and neutron diffraction measurements on NpSe and NpTe are presented. Magnetic properties of NpRu/sub 2/Si/sub 2/ are also presented. Heavy fermion system electronic and magnetic properties are described and theory is discussed. Electronic and magnetic properties of CeCu/sub 2/ Si/sub 2/, CeRu/sub 2/Si/sub 2/ and URu/sub 2/ Si/sub 2/ are compared to NpRu/sub 2/Si/sub 2/ which has the same crystal structure.

11329 (GKSS—88/E/32) Microstructural analyses of intermetallic TiAl(Nb)-compounds prepared by arc melting and by powder metallurgy. Chen, S. (GKSS-Forschungszentrum Geesthaacht G.m.b.H., Geesthacht-Tesperhude (Germany, F.R.). Inst. fuer Werkstofforschung). (GKSS-Forschungszentrum Geesthacht G.m.b.H., Geesthacht-Tesperhude (Germany, F.R.); Technische Univ. Hamburg-Harburg (Germany, F.R.)). 1988. 168p. NTIS (US Sales Only), PC A08/MF A01. Order Number DE88756346/JAW.

Intermetallic compounds based on TiAl with Nb or V as alloying additions prepared by powder metallurgy (P/M) and arc melting (A/M) techniques have been investigated with respect to their potential as new high temperature materials. All the alloys

with nominal Al-concentrations 34-36 wt% contain two phases, γ-TiAl and α/sub 2/-Ti/sub 3/Al, but significant differences in the distribution of γ and α/sub 2/ were found between the P/M and A/M materials. The role of impurities during processing and the microstructural stability in the planned service temperature range 700-1000/sup 0/C are discussed. In the P/M TiAl alloys two carbide precipitates have been found, which are the cubic Perovskite-AlTi/sub 3/C phase in the γ-matrix and the hexagonal H-AlTi/sub 2/ (C, N) phase at grain boundaries. At high temperatures the AlTi/sub 3/C phase dissolves and is replaced by more stable H-phase, and therefore no longer contributes to the high temperature strength of the material. Mechanical properties of both the P/M and A/M alloys are compared in association with the processing methods and the resulting microstructures. (orig.) With 71 figs., 22 tabs.

11330 **(GKSS—88/E/33) Microstructure and toughness of ferritic weld metal of hyperbaric welded joints.** Mueller, L. (GKSS-Forschungszentrum Geesthacht G.m.b.H., Geesthacht-Tesperhude (Germany, F.R.). Inst. fuer Werkstofforschung). (GKSS-Forschungszentrum Geesthacht G.m.b.H., Geesthacht-Tesperhude (Germany, F.R.); Technische Univ. Hamburg-Harburg (Germany, F.R.)). 1988. 120p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88756347/JAW.

In the present work ferritic weld metals of hyperbaric MIG/MAG welds with pressures up to 100 bar were examined. As a result of the pressure, interactions with the shielding gas, the filler metal as well as with the welding parameters had to be expected and were consequently included in the analysis. Investigation was focused on the influence of these parameters on the chemical composition of the weld metals, the microstructure and toughness behaviour, including fracture mechanics test. Using quantitative microstructural analysis as well as fractography a correlation between microstructure and toughness has been shown.

11331 **(GKSS—88/E/34) Finite element analysis for calculation of calibration curves for measurement of crack propagation for elliptical surface cracks.** Dietrich, R.A.; Schoenfeld, W. (GKSS-Forschungszentrum Geesthacht G.m.b.H., Geesthacht-Tesperhude (Germany, F.R.). Inst. fuer Anlagentechnik). (GKSS-Forschungszentrum Geesthacht G.m.b.H., Geesthacht-Tesperhude (Germany, F.R.); GKSS-Forschungszentrum Geesthacht G.m.b.H., Geesthacht-Tesperhude (Germany, F.R.). Inst. fuer Anlagentechnik). 1988. 28p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756348/JAW.

The finite element method is utilized to calculate the calibration curves for measurement of crack propagation for elliptical surface cracks in fracture mechanics specimens. The calibration curves are required for measurement of the crack propagation using the electrical direct-current method. In this report the calibration curves are calculated for fracture mechanics specimens with the thickness B=5 mm, 10 mm, 15 mm, 18 mm and 20 mm. The starting crack is b/sub 0/=2 mm for all specimens. (orig.) With 16 figs.

11332 **(HMI-B—450) Neutron beam tomography software.** Newbery, A.C.R. (Hahn-Meitner-Institut Berlin G.m.b.H. (Germany, F.R.). Bereich Datenverarbeitung und Elektronik). May 1988. 48p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756357/JAW.

When a sample is traversed by a neutron beam, inhomogeneities in the sample will cause deflections, and the deflections will permit conclusions to be drawn concerning the location and size of the inhomogeneities. The associated computation is similar to problems in tomography, analogous to X-ray tomography though significantly different in detail. We do not have any point-sample information, but only mean values over short line segments. Since each mean value is derived from a separate neutron counter, the quantity of available data has to be modest; also, since each datum is an integral, its geometric precision is inferior to that of X-ray data. Our software is designed to cope with these difficulties.

11333 **(IS-RIC—10) Two hundred years of rare earths, 1787--1987.** Gschneidner, K.A. Jr.; Capellen, J. (ed.). (Iowa State Univ. of Science and Technology, Ames (USA)). 1987. Contract W-7405-ENG-82. 32p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89003842/JAW.

The Rare-earth Information Center celebrated the 200th anniversary of the discovery of ytterbite by inviting its readers to write stories on what the readers thought were some of the important highlights of the first 200 years of rare earths. Four of these stories were published, in a shortened version, in one of the four quarterly issues of the {ital RIC News}. All of the stories submitted, including the four published, were to be part of a booklet published by RIC and to be distributed to any one requesting it. RIC decided to include a "letter to the editor" and the editor's response concerning the year Arrhenius made his initial discovery. Also, we have included a 1984 article which was written on the occasion of a special issue commemorating the 100th volume of the {ital Journal of the Less-Common Metals}. In this paper, K.A. Gschneidner Jr., reviews the history and current events of rare earth metallurgy and makes some observations concerning its future {endash} an appropriate concluding paper in this special booklet. In July of 1987 North-Holland Physics Publishing offered to typeset, print and publish these articles as a joint RIC{endash}North-Holland publication. And this is the result. 52 refs., 2 figs., 3 tabs.

11334 **(Juel—2134) Investigation of the vibrational behaviour of radiation induced interstitials in Al by means of inelastic diffuse neutron scattering.** Urban, R. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Festkoerperforschung; Technische Hochschule Aachen (Germany, F.R.)). May 1987. 113p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88756509/JAW.

Diffuse inelastic neutron scattering measurements have been performed for the first time to study the dynamics of self interstitial atoms (SIA). In order to produce a random distribution of individual SIA's the defects were produced by irradiation of Aluminium with 3 MeV electrons. The measurements were made at 6 K on the sample before annealing and after annealing at 46 K (above stage I) and at ≈300 K (after complete recovery). The irradiated sample showed a significant increase of the inelastic scattering intensity at transferred energies between 0.7 THz and 2 THz. By comparison with the results of computer calculations this broad frequency spectrum could be attributed to contributions of different vibration modes of the interstitial atoms. (orig./BHO).

11335 **(Juel—2183) Data basis of the solubilities of the hydrogen isotopes protium (H), deuterium (D) and tritium (T) in the metals V, Nb, Ta, Pd and in the alloys V/sub 1-x/Nb/sub x/, V/sub 1-x/Ta/sub x/, Nb/sub 1-x/Mo/sub x/, Pd/sub 1-x/Ag/sub x/.** Laesser, R.; Meuffels, P.; Feenstra, R. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Festkoerperforschung). Feb 1988. 207p. (In German). NTIS (US Sales Only), PC A10/MF A01. Order Number DE88756374/JAW.

This JueL-report is a documentation of solubility data of the hydrogen isotopes protium and/or deuterium and/or tritium in the metals V, Nb, Ta, Pd and alloys V/sub 1-x/Nb/sub x/, V/sub 1-x/Ta/sub x/, Nb/sub 1-x/Mo/sub x/, Pd/sub 1-x/Ag/sub x/. The solubility has been determined by measurements of the pressure drop or increase, the pressure itself, the sample temperature and by the knowledge of the effective temperature, the volume and the sample mass. The JUeL-report shows the hydrogen solubility graphically in the form of the usual isotherms, but the main purpose is the numerical presentation of the equilibrium pressures, sample temperatures and hydrogen concentrations (given as ratio of hydrogen - to metal atoms).

11336 **(Juel—2225) Influence of implanted helium on the mechanical properties of the martensitic steel DIN 1.4914 at high temperatures.** Stamm, U. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Festkoerperforschung; Technische Hochschule Aachen (Germany, F.R.)). Aug 1988. 72p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88756512/JAW.

Experiments with low helium concentrations suggest that ferritic-martensitic steels are more resistant against helium embrittlement that austenitic steels. In this work the effects of fusion-relevant high helium concentrations on the mechanical properties of the fully martensitic steel DIN 1.4914 (the reference material for NET) has been studied. Foil specimens of 90 μm thickness of two different heats were homogeneously implanted with helium by a cyclotron under various conditions. Tensile tests were performed at temperatures from 273 K to 973 K and creep tests at 873 K and 973 K with specimens preimplanted at test temperatures. 'In-beam' tests (creep to rupture under simultaneous implantation) were carried out at 873 K and 973 K with helium concentrations up to 3000 and 2700 appm, respectively. The ruptured specimens were investigated for fracture mode (SEM) and helium bubble microstructure (TEM).

11337 **(Juel-Spez—468) In-beam experiments on irradiation creep of stainless steels.** Jung, P. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Festkoerperforschung). Sep 1988. 17p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756514/JAW.

This report contains a very short overview with 23 bibliographies about the following themes: 1.) Dependence of irradiation creep of austenitic stainless steel on irradiation parameters (e.g. AISI 316) 2.) Effect of stress on swelling of austenitic stainless steel. 3.) Effect of minor alloying elements (Si,P) on swelling of austenitic steels (e.g. AISI 316) at 500 deg C. 4.) Irradiation creep of martensitic stainless steels (DIN 1.4914) 5.) Irradiation creep in solution-, precipitation- and dispersion hardened nickel alloys 6.) Correlation of displacement rates of simulation particles to fusion neutrons.

11338 **(KFK—4374) Non-isothermal theory of thermoelastic shells under large deformations. Pt. 1. Evaluation of energy balance conditions.** Malmberg, T. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorentwicklung). Sep 1988. 226p. (In German). NTIS (US Sales Only), PC A11/MF A01. Order Number DE88756385/JAW.

The (well known) three-dimensional theory of nonlinear thermoelastic bodies is delineated; the derivation of the three-dimensional field equations is done on the basis of the two basic thermodynamic principles in integral form and their form-invariance under observer transformations. After summarizing essential results of the differential geometry of surfaces the form-invariance of the energy balance equation (integrated across the shell thickness) and the energy condition are evaluated. It is found that still some freedom is present in the choice of the additional actions.

11339 **(KFK—4375) Non-isothermal theory of thermoelastic shells under large deformations. Pt. 2. Evaluation of entropy balance conditions.** Malmberg, T. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorentwicklung). Sep 1988. 331p. (In German). NTIS (US Sales Only), PC A15/MF A01. Order Number DE88756386/JAW.

The entropy condition for the virtual agencies and the integral Clausius-Duhem entropy inequality are evaluated for two shell concepts. This is accompanied by a direct ansatz for the two-dimensional constitutive relations which have to be form-invariant under observer transformations. The two-dimensional mechanical constitutive relations are of special interest; they relate weighted averages of the stresses across the shell thickness (e.g. moments of 0., 1. and 2. order) and kinematic quantities as well as quantities characterizing the temperature field. The study is concluded by the derivation of the corresponding kinematic, dynamic and thermal boundary conditions. Also the development is supplemented by a component representation of the shell equations referred to the undeformed reference configuration using Lagrangian coordinates.

11340 **(LA-UR—88-3794) An embedded atom potential for bcc iron.** Harrison, R.J.; Voter, A.F.; Shao-Ping Chen. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 6p. (CONF-880901—11). NTIS, PC A02 - OSTI. Order Number DE89003577/JAW.

From Metallurgical Society fall meeting and American Society for Metals materials week; Chicago, IL, USA (24 Sep 1988).

We have used the embedded atom method (EAM) to construct inter atomic potentials for use with bcc iron. Our original motivation for this work was to model the grain boundaries in iron. The version of the EAM we have used is where the total energy is given as the sum of two body terms summed over pairs of atoms i,j, together with an embedding term given by the sum of embedding functions whose arguments are the total electronic charge density at the sites i. A Morse potential with the three parameters v_1, v_2 and v_3, is used to represent the two-body terms. The total electronic charge densities at each individual site which are the arguments of the embedding functions, are obtained from the linear superposition of atomic 4s Slater function charge densities of form. The fifth parameter v_5 is taken as the cutoff distance for the atomic charge densities and for phi(r/sub ij/), which are adjusted for smoothness at cutoff. The embedding function itself is determined by the fit of the cohesive energy of bcc iron as a function of interatomic distance to the "universal" cohesive energy function described by Rose et al. 15 refs., 1 tab.

11341 **(NP—9770181) Propagation of circumferential cracks in pipes under four-point bonding load.** Grunmach, R. (Karlsruhe Univ. (T.H.) (Germany, F.R.). Fakultaet fuer Maschinenbau). 16 Dec 1986. 150p. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE89770181/JAW.

The certainly most frequent failure mechanism for pipelines is crack propagation, which either leads to separation fracture of the pipe or to leakage. The study examines crack propagation in pipes under a four-point bending load using the method of J integral analysis and that of plastic collapse. (HAG).

11342 **(PNL-SA—15535) An assessment of Fe-Cr-Mn austenitic alloys for fusion service using fast reactor irradiation.** Garner, F.A.; McCarthy, J.M. (Pacific Northwest Lab., Richland, WA (USA)). 1988. Contract AC06-76RL01830. 22p. (CONF-880613—25). NTIS, PC A03/MF A01 - OSTI. Order Number DE89003916/JAW.

From 14. international symposium on effects of radiation on materials; Andover, MA, United States (27 Jun 1988).

A series of model Fe-Cr-Mn alloys and various solute-modified high manganese alloys have been irradiated in the Fast Flux Test Facility in order to provide an early assessment of the consequences of substituting manganese for nickel in austenitic stainless steel. The purpose of this substitution is to reduce the level of long term radioactivation of this alloy, a candidate structural material for use in fusion energy devices. Simple Fe-Mn and Fe-Cr-Mn alloys were found to exhibit much of the same behavior observed in Fe-Ni and Fe-Ni-Cr alloys. In particular, they tend to swell at {approximately}1%/dpa after an incubation period that is dependent on irradiation temperature, alloy composition and cold working. The phase stability, both in and out of reactor, is altered substantially by the substitution of manganese, however. It nonetheless appears that appropriate levels of solute modification can be used to improve both the swelling resistance and phase stability. An alloy with a base composition of Fe-20Mn-15Cr appears to offer the best promise for further research. 24 refs., 9 figs., 4 tabs.

11343 **(PNL-SA—15955) Segregation to surfaces in irradiated stainless steels.** Simonen, E.P.; Bradley, E.R.; Jones, R.H. (Pacific Northwest Lab., Richland, WA (USA)). Nov 1988. Contract AC06-76RL01830. 27p. (CONF-880613—27). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005156/JAW.

From 14. international symposium on effects of radiation on materials; Andover, MA, United States (27 Jun 1988).

An irradiated 316 SS alloy consistently showed phosphorus segregation to surfaces at temperatures in which thermal segregation is negligible. Phosphorus segregation did not occur in other irradiated 300 series alloys examined. The segregation model of Lam et al. was used to show that interstitial-solute binding and migration is a likely mechanism for the measured irradiation-induced phosphorus segregation. Surface segregation of sulfur was observed, but the segregation mechanism was not established. Segregation of other impurities such as silicon, and nitrogen or alloying elements such as chromium were not observed. 21 refs., 8 figs., 2 tabs.

11344 **(SAND—88-1580C) Dynamics of growth roughening and smoothening on Ge (001).** Chason, E.; Tsao, J.Y.; Horn, K.M.; Picraux, S.T. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 16p. (CONF-8809196—1). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89003611/JAW.

From 9. molecular beam epitaxy workshop; West Lafayette, IN, USA (21 Sep 1988).

We present reflection high-energy electron diffraction measurements of the evolution of surface morphology during molecular beam epitaxy of Ge on Ge (001) and subsequent annealing. We find that there is a critical "growth roughening" temperature (375 C) above which a smooth surface remains smooth during growth, but below which it roughens during growth. Surprisingly, smooth starting surfaces never appear to roughen without bound, but reach steady-state roughnesses which depend on temperature and deposition rate. The results can be fit empirically with simple phenomenological equations based on a competition between growth roughening and growth smoothening of a "pseudo-statistical" surface. Furthermore, growth-roughened surfaces tend to smoothen, after growth, at a rate consistent with an Ostwald-like ripening mechanism. 4 figs.

11345 **(SAND—88-1644C) Argon ion bombardment during molecular beam epitaxy of Ge(001).** Chason, E.; Horn, K.M.; Tsao, J.Y.; Picraux, S.T. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 5p. (CONF-881155—16). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004378/JAW.

From Fall meeting of the Materials Research Society; Boston, MA, USA (28 Nov 1988).

Using in situ, real-time reflection high energy electron diffraction (RHEED), we have measured the evolution of Ge (001) surface morphology during simultaneous molecular beam epitaxy and Ar ion beam bombardment. Surprisingly, low-energy Ar ions during growth tend to smoothen the surface. Bombardment by the ion beam without growth roughens the surface, but the surfaces can be reversibly smoothened by restoring the growth beam. We have measured the effect of such "ion beam growth smoothening" above and below the critical temperature for intrinsic growth roughening. At all measured growth temperatures the surface initially smoothens but below the critical roughening temperature the final surface morphology is rough whereas above this temperature the final morphology is smooth. 9 refs., 3 figs.

11346 **(SAND—88-2674C) Plasma oxidation of Sn-Pb surfaces and its effect on solderability.** Lopez, E.P.; Hosking, F.M.; Buttry, R.W. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 13p. (CONF-8810159—2). NTIS, PC A03/MF A01 - OSTI. Order Number DE89003386/JAW.

From 3. inter-agency cleaning and contamination control seminar; Kansas City, MO, USA (18 Oct 1988).

The effect of plasma oxidation on the solderability of tin-lead surfaces was studied. Auger Electron Spectroscopy was used to determine the relative oxide thickness resulting from oxygen plasma treatments. The oxide layer was generally thin and ranged from approximately 32 to 102 {angstrom}. Solderability was determined with a meniscometer and meniscograph electrobalance. Wetting of the plasma etched samples varied from very good to excellent with contact angles of 15 to 25 degrees and wetting rates of 244 to 264 dyne{center←dot}cm^{-1}{center←dot}s^{-1}. The plasma treatment did not significantly reduce the solderability of the pretinned surfaces. 4 refs., 6 figs., 1 tab.

11347 **(SAND—88-3152C) Preparation of thin and thick film superconductors in the Ti-Ca-Ba-Cu-O System.** Ginley, D.S.; Kwak, J.F.; Venturini, E.L.; Mitchell, M.A.; Hellmer, R.P.; Morosin, B.; Baughman, R.J. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 11p. (CONF-881127—2). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005058/JAW.

From Conference on the science and technology of thin film superconductors; Colorado Springs, CO, USA (14 Nov 1988).

Our recent success with the Tl-based materials has led us to focus on these materials. In this paper we briefly summarize our results in this material system in bulk ceramic, thick film and thin film forms. The object of the paper is not to be all inclusive but to express some of the connected aspects of the processing, their relationship to the superconducting properties of all of these materials, and to speculate on future directions for processing. 17 refs., 3 figs., 2 tabs.

11348 **(UCRL—99977) Phases and microstructures of carbon-implanted niobium.** Huang, J.S.; Musket, R.G.; Wall, M.A. (Lawrence Livermore National Lab., CA (USA)). Nov 1988. Contract W-7405-ENG-48. 6p. (CONF-881155—14). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004017/JAW.

From Fall meeting of the Materials Research Society; Boston, MA, USA (28 Nov 1988).

Polycrystalline niobium was implanted with 200, 100, and 50 keV carbon ions to create a uniform distribution of carbon over a thickness of about 0.25 μm. Samples implanted with calculated carbon content of 0.6, 1.9, 5.8, and 16 atomic percent were prepared, and the uniformity of the carbon distribution with depth was confirmed by Auger electron spectroscopy analysis. Glancing-angle x-ray diffraction analysis and transmission electron microscopy were used to characterize the phases and microstructures formed. The results indicated that no detectable second phases were present except on the surfaces where an amorphous phase and many particles were formed from contamination. Despite the low equilibrium solubility limit of carbon in Nb, we have created metastable solid solutions of Nb and C with carbon contents as high as 16 at.%. 7 refs., 5 figs., 1 tab.

11349 **(UJV—8324-M) Mechanical properties of zirconium alloy cladding tubes and critical fuel element power ramps.** Novak, J.; Lauerova, D. (Ustav Jaderneho Vyzkumu CSKAE, Rez (Czechoslovakia)). Apr 1988. 12p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705314/JAW.

The study of the mechanism of cladding dehermetization in power ramps made it possible to substantiate and to specify an originally empirical correlation between hoop fracture strain measured after internal pressurization ϵ/sub f/ and critical power ramp value ΔN/sub C/. The relation of conventional mechanical properties, of fracture toughness in iodine atmosphere k/sub ISCC/ and of ΔN/sub C/ were found. In the present version, correlation of ϵ/sub f/ and ΔN/sub C/ is based on a semiempirical model having certain physical interpretation. To quantitate this correlation, it is now sufficient to know a single point based on power ramp experiments in a materials testing reactor. Typical ΔN/sub C/ values for BWR's and PWR's confirm model predictions and thus may be considered as verification of the proposed model. More accurate assessment was obtained of ΔN/sub C/ = 13 kW/m for WWER fuel elements with Zr1Nb cladding, irradiated to saturation at 300 degC. A job to find ΔN/sub C/ for higher cladding temperatures typical for WWER-440 and WWER-1000 reactors is thus transformed to the determination of the cladding mechanical properties after irradiation at corresponding temperatures. (author). 3 figs., 2 tabs., 26 refs.

11350 **(Y—2396) Directly susceptible Tribocor 532N crucibles for noncarbon uranium melting and casting.** Holcombe, C.E. Jr.; Dykes, N.L.; Reiner, R.H.; Walker, L.R. (Oak Ridge National Lab., TN (USA)). 31 Oct 1988. Contract AC05-84OR21400. 41p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89002808/JAW.

A new material, Tribocor 532N [an alloy of 50 wt % niobium-30 wt % titanium-20 wt % tungsten (50Nb-30Ti-20W) nitrided at >1800{degree}C], has been shown to be an excellent crucible/susceptor for melting and casting uranium and its alloys in a noncarbon environment. Testing has progressed from very small-scale initial tests to intermediate-scale foundry tests with performance better than graphite containment. Lifetime tests of Tribocor 532N indicate an improvement of more than an order of magnitude as compared to graphite. The Tribocor 532N is far superior to oxide-based ceramics and experiences no cracking from thermal cycling, is capable of directly suscepting in an induction field for induction heating, and is stable with graphite---allowing any portion of a graphite stack to be replaced interchangeably with Tribocor 532N. Tribocor 532N can be coated with standard paint, and it performs

equally well with the more economical zirconia coating instead of yttria, while also being compatible with erbia coatings that are suitable for enriched uranium. Since Tribocor 532N contains no carbon, a Tribocor crucible should introduce less carbon during melt cycles and enable more recycled metal to be used without increasing carbon levels. The long lifetime projections for Tribocor 532N make the material economical. A large-scale crucible of Tribocor 532N will be tested. 14 refs., 11 figs., 7 tabs.

11351 **(Y—2404) Surface preparation of IPNS [Intense Pulsed Neutron Source] booster target components prior to diffusion bonding.** Simandl, R.F.; Richards, H.L.; Thompson, L.M. (Oak Ridge Y-12 Plant, TN (USA)). 6 Oct 1988. Contract AC05-84OS21400. 27p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005306/JAW.

In support of Argonne National Laboratory's Intense Pulsed Neutron Source (IPNS) program, the Oak Ridge Y-12 Plant has fabricated 15 Zircaloy-2 clad, enriched uranium booster targets using hot isostatic pressing (HIP) to effect diffusion bonding between the enriched uranium core and the Zircaloy-2 cladding. Guided by x-ray photoelectron spectroscopy for chemical analysis (XPS/ESCA) data, surface preparation procedures for both the Zircaloy-2 and uranium were refined to ensure 100% bonding between the dissimilar metals and survival of the rigors of beta quenching. 7 refs., 11 figs., 4 tabs.

11352 **Anharmonicity and the equation of state for gold.** Anderson, O.L.; Isaak, D.G.; Yamamoto, S. (Institute of Geophysics and Planetary Physics University of California, Los Angeles, California 90024). *Journal of Applied Physics;* **65**: No. 4, 1534-1543(15 Feb 1989).

The temperature dependence of the thermodynamic and the elastic properties of elemental gold are found from published data. It is shown that measurements for (partialK/sub T//partialP)/sub T/ near 5.5 are more thermodynamically consistent than are higher values of this parameter which have been reported earlier. Using 5.5 for (partialK/sub T//partialP)/sub T/, we find that (partialK/sub T//partialT)/sub V/ is not zero but -11.5 x 10^{-3} GPa K^{-1} for high temperatures ($T>\theta$/sub D/, where θ/sub D/ is the Debye temperature). One consequence of this is that above θ/sub D/ the thermal pressure, P/sub TH/, along the room-pressure isobar can be expressed as P/sub TH/(T)-P/sub TH/(300) = [7.14 x 10^{-3} +(partialK /sub T//partialT)/sub v/ ln(V/sub a//V)] x (T-300) GPa for T an absolute temperature and V/sub a/ being the volume at ambient conditions. These results give thermal pressure values near those previously reported at small compressions, but give lower thermal pressures at large compressions. This study suggests that in order to ensure thermodynamic consistency, the value of d ln γ/d ln V is near 2.5—3.0 which is higher than values of 1.0 and 1.7 reported previously (γ is the Grueneisen ratio). Calculations giving the compressional and shear wave velocities, v/sub p/ and v/sub s/, are also presented.

11353 **Observation of a precursor during the crystallization of amorphous $NiZr_2$.** Sutton, M.; Yang, Y.S.; Mainville, J.; Jordan-Sweet, J.L.; Ludwig K.F. Jr.; Stephenson, G.B. (Department of Physics, McGill University, 3600 University Street, Montreal, Quebec, Canada H3A 2T8). *Physical Review Letters;* **62**: No. 3, 288-291(16 Jan 1989).

In situ studies of the isothermal crystallization of an amorphous alloy ($NiZr_2$) have been performed using time-resolved x-ray diffraction, with a time resolution as short as 3 ms. In the temperature range studied (628—680 K), a transient structural precursor is present during the crystallization. The maximum volume fraction reached by this precursor during crystallization increases with the rate of crystallization.

11354 **Anisotropy of the magnetic-field—induced phase transition in superconducting UPt_3.** Schenstrom, A.; Xu, M.; Hong, Y.; Bein, D.; Levy, M.; Sarma, B.K.; Adenwalla, S.; Zhao, Z.; Tokuyasu, T.; Hess, D.W.; and others. (Department of Physics, University of Wisconsin—Milwaukee, Milwaukee, Wisconsin 53201). *Physical Review Letters;* **62**: No. 3, 332-335(16 Jan 1989).

Measurements of the attenuation of longitudinal ultrasound in superconducting UPt_3 show a peak, below H/sub $c/_2$, which depends strongly on the orientation of the field relative to the c axis. We propose an explanation of this peak in terms of a vortex phase transition in an unconventional superconducting state, which is consistent with recent neutron-scattering data.

11355 **Temperature dependence and anharmonicity of the Debye-Waller factor in sodium metal using Moessbauer γ-ray diffraction.** Crow, M.L.; Schupp, G.; Yelon, W.B.; Mullen, J.G.; Djedid, A. (Research Reactor and Department of Physics and Astronomy, University of Missouri, Columbia, Missouri 65211). *Physical Review [Section] B: Condensed Matter;* **39**: No. 2, 909-914(15 Jan 1989).

The Debye-Waller factor of sodium has been measured as a function of temperature from 80 to 295 K using Moessbauer γ-ray scattering. The high energy resolution provided by this technique allowed experimental separation of the elastic scattering from the inelastic thermal diffuse scattering. The results were compared with the harmonic model using integrations over dispersion curves from the neutron-scattering measurements of Woods et al. and the lattice-dynamics calculations of Glyde and Taylor. The Debye-Waller exponent was shown to exceed the harmonic prediction by 23% at room temperature. This difference is attributed to anharmonic terms in the interatomic potential.

11356 **First-principles determination of the bulk phase diagram for body-centered-tetragonal copper: Application to epitaxial growth of Cu on Fe{100}.** Morrison, I.A.; Kang, M.H.; Mele, E.J. (Department of Materials Science and Engineering and The Laboratory for Research on the Structure of Matter, University of Pennsylvania, Philadelphia, Pennsylvania 19104). *Physical Review [Section] B: Condensed Matter;* **39**: No. 3, 1575-1580(15 Jan 1989).

From the results of our ab initio pseudopotential total-energy calculation on Cu in the body-centered-tetragonal (bct) crystal system, a first-principles phase diagram for bulk bct Cu is derived as a function of externally applied stresses. An interesting fcc-to-bcc structural transition is predicted, induced by the application of a biaxial tension and a hydrostatic pressure. The biaxial tension needed to initiate the transformation is found, however, to be too large to attain macroscopically without inducing plastic flow (i.e., dislocation motion) in single crystal copper. An explanation for the existence of a metastable (albeit rather disordered) phase of bcc Cu on an iron substrate, recently observed by Wang et al., is put forth by considering the energy of tetragonal distortions on the cubic phases of Cu. The results of our bulk bct calculations suggest that the disorder observed on Cu/Fe{100} is due to a nonoptimal match of lattice constants. The growth of a stable bct phase of Cu on a suitable cubic substrate with lattice constant 2.76 A may be possible.

11357 **First-principles calculation of impurity-solution energies in Cu and Ni.** Drittler, B.; Weinert, M.; Zeller, R.; Dederichs, P.H. (Institut fuer Festkoerperforschung der Kernforschungsanlage Juelich, D-5170 Juelich, Federal Republic of Germany). *Physical Review [Section] B: Condensed Matter;* **39**: No. 2, 930-939(15 Jan 1989).

We present ab initio calculations for the solution energies of 3d impurities in Cu and Ni hosts. The calculations are based on density-functional theory and the KKR Green's-function method. We apply a grand-canonical energy functional which is extremal against non-particle-conserving charge variations and give an extension of Lloyd's formula for complex energies. The full nonsphericity of the charge density is used in the double counting terms. Test calculations show that it is sufficient to take the perturbation of one shell of host atoms around the impurity into account. The calculated solution energies of 3d impurities in Cu and Ni are in good agreement with the experimental data and with the values predicted by Miedema's model.

11358 **Interference of surface relaxations in unsupported thin films.** Chen, S.P.; Voter, A.F.; Albers, R.C. (Theoretical Division, Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Physical Review [Section] B: Condensed Matter;* **39**: No. 2, 1395-1398(15 Jan 1989).

We present embedded-atom simulations of interlayer relaxations in very thin slabs of Al and NiAl with (110) and (210) sur-

faces. The interlayer spacing at a given depth from the surface depends strongly on the slab thickness. For example, the value of the first-layer contraction exhibits a decaying oscillation about that for a semi-infinite solid as the slab thickness is increased. These effects can be understood as an interference of the relaxations from each of the two free surfaces of the slab. This interference model provides quantitative predictions of the slab interlayer spacings.

11359 **Pseudoexcitons in mixed-valence metals.** Liu, S.H. (Solid State Division, Oak Ridge National Laboraotry, Oak Ridge, Tennessee 37830). *Physical Review [Section] B: Condensed Matter;* **39**: No. 2, 1403-1406(15 Jan 1989).

Recent neutron scattering studies of the phonon dispersion relations of α-Ce and $CePd_3$ have revealed a mode splitting in the (100) LA branch around the spin-fluctuation temperature. It is shown that this behavior could be caused by the mixing of LA phonons with excitonlike entities formed by localized f holes and broad-band electrons.

11360 **Symmetry-restricted anharmonicities and the CsCl-to-7R martensitic structural phase transformation of the Ni/sub x/Al/sub 1-//sub x/ system.** Gooding, R.J.; Krumhansl, J.A. (Laboratory of Atomic and Solid State Physics, Cornell University, Ithaca, New York 14853-2501). *Physical Review [Section] B: Condensed Matter;* **39**: No. 3, 1535-1540(15 Jan 1989).

We suggest that the CsCl-to-7R structural transition undergone by Ni/sub x/Al/sub 1-//sub x/, where 0.6approx. <xapprox. <0.65, may be attributed to the anharmonic interaction between the $\Sigma_4\{011\}$ phonons and the homogeneous strains associated with the (1/2(c/sub 11/-c/sub 12/) elastic constant. We show that the strains predicted by this theory are compatible with those of the experimentally observed 7R monoclinic unit cell. Also, we purport that the temperature dependence of the elastic constant (1/2(c/sub 11/-c/sub 12/) is responsible for the very strong dependency of the martensitic start temperature on Ni concentration. Further, if above the transition the minimum of the dip of the Σ_4 phonon occurs at $\xi_0(0,1,1)$, we show that, since, in principle, there must be a wave-vector dependence of the Landau coefficients appearing in the free-energy expansion, the modulation in the martensitic phase must correspond to ξ/sup */(0,1,1), where (i) ξ/sup */ cannot be equal to ξ_0 and (ii) ξ/sup */ need not correspond to a commensurate lock-in value.

11361 **Experimental evidence for room-temperature intermetallic compound formation at the Pd/Al interface.** Jiang, L.Q.; Ruckman, M.W.; Strongin, M. (Physics Department, Brookhaven National Laboratory, Upton, New York 11973-5000). *Physical Review [Section] B: Condensed Matter;* **39**: No. 3, 1564-1568(15 Jan 1989).

The growth of Pd films on Al and Pd/Al interface formation were studied with use of ultraviolet photoemission spectroscopy (UPS) and low-energy ion scattering. At room temperature, the deposited Pd intermixes with the Al substrate and forms a thin surface alloy about 5 monolayers (ML) thick. Bulklike Pd states start to build up at E/sub F/ when the Pd coverage exceeds 4 ML. More than 8 ML of Pd are needed to completely cover the Al substrate and to fully develop the Pd metallic valence band. A Pd4d—derived band centered at 4 eV below E/sub F/ was observed both for monolayer Pd coverage on Al and for thick Al on Pd. It is argued that this deep-lying d band is due to the interaction between Pd and Al through the hybridization of the Pd d and Al s states.

11362 **Line narrowing in photoemission by coincidence spectroscopy.** Jensen, E.; Bartynski, R.A.; Hulbert, S.L.; Johnson, E.D.; Garrett, R. (Physics Department, Brandeis University, Waltham, Massachusetts 02254). *Physical Review Letters;* **62**: No. 1, 71-73(2 Jan 1989).

We present photoemission spectra from the 3p level of Cu(100) obtained in coincidence with the M_3VV Auger line. The 3p level is narrowed from its 2.2-eV core-lifetime-broadened width to 1.0 eV, representing the intrinsic width of the ^1G Auger final state. The core line changes its energy within the 2.2-eV envelope as the Auger coincidence energy is changed, conserving the sum of Auger-electron and photoelectron kinetic energies.

11363 **Spin-fluctuation spectra measured on a single crystal of $CePd_3$.** Shapiro, S.M.; Stassis, C.; Aeppli, G. (Laboratoire Leon Brillouin, C.E.N. Saclay, 91191 Gif-Sur-Yvette CEDEX, France). *Physical Review Letters;* **62**: No. 1, 94-97(2 Jan 1989).

Temperature-dependent inelastic-neutron-scattering measurements were performed on a single crystal of $CePd_3$ over the energy range $-10<(h/2\pi)\omega<80$ meV. The spectral response cannot be described by a single Lorentzian line as has been used for previous measurements on polycrystalline samples. The two energy scales which emerge from the data analysis correspond to those found in bulk measurements.

11364 **Quadrupole resonances in the rare-earth metals.** Liberman, D.; Zangwill, A. (Lawrence Livermore National Laboratory, Livermore, California 94550). *Physical Review [Section] A: General Physics;* **39**: No. 1, 415-416(1 Jan 1989).

Calculations that employ a relativistic time-dependent local-density approximation to atomic absorption are used to examine a recent claim to the observation of giant quadrupolar resonances in the electron-energy-loss spectrum of Ce metal near the 4p edge. We confirm the existence of 4p→4f resonances in this energy range but find the polarization effects much smaller than in typical giant dipole resonances.

11365 **Fatigue crack path measurements in an alpha-beta titanium alloy.** Margolin, H.; Hoo, H.L. pp 131-136 of Microstructure fracture toughness and fatigue crack growth rate in titanium alloys; Proceedings of the 1987 TMS-AIME Annual Symposium, Denver, CO, Feb. 24, 25, 1987. Chakrabarti, A.K.; Chesnutt, J.C. Warrendale, PA; Metallurgical Society, Inc. (1987). (CONF-8702164—).

From Microstructure fracture toughness and fatigue crack growth rate in titanium alloys; Denver, CO, USA (24 Feb 1987).

Quantitative measurements have been made of the relationship between microstructure and fatigue crack path in smooth specimens of a Ti-5.25Al-5.5V-0.9Fe-0.5Cu alloy subjected to bending fatigue. For both equiaxed and Widmanstatten structures, the volume function of alpha, f(alpha) along the fatigue crack was larger than f(alpha) along a random line. For equiaxed structures, the fatigue crack tended to travel to the nearest alpha particle. In Widmanstatten structures, the crack did not pick out the nearest particle, but rather appeared to travel toward groups of alpha particles. Crack path fluctuations about the general crack direction were much more pronounced for the Widmanstatten than for the equiaxed structure. The fluctuations increased as the ratio between the grain boundary alpha thickness and the interalpha particle spacing decreased. 10 references.

11366 **(ORNL/tr—88/37) Hot mechanical properties of iron-aluminum alloys with a high aluminum content.** Sainfort, G.; Mouturat, P.; Pepin, P.; Petit, J.; Cabane, G.; Salessee, M. Translated from *Memoires Rev. Metallurg ;* No. 2, vp(1963). Contract AC05-84OR21400. 28p. (CONF-8210145—3). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004466/JAW.

From Autumn metallurgy meeting; Paris, France (19 Oct 1982).

We present a few results pertaining to the hot mechanical properties of these alloys and in particular alloys containing 25 wt% of aluminum, called iron-aluminum 40 because of their atomic content in aluminum. The following areas are discussed: preparation, shock resistance, tensile stress strengthen, and fracture. 8 refs., 22 figs., 1 tab.

3602 Ceramics, Cermets, And Refractories

REFER ALSO TO CITATION(S) 10923, 10969, 11347, 11486, 11521, 12339, 12350, 12364, 12365, 12370

11367 (AD-A—198908/6/XAB) Direct evidence of the importance of electron-phonon coupling in La^2CuO_4: photoinduced ir-active vibrational modes. Technical report. Kim, Y.H.; Heeger, A.J.; Acedo, L.; Stucky, G.; Wudl, F. (California Univ., Santa Barbara (USA). Inst. for Polymers and Organic Solids). 1 Nov 1987. 6p. (IPOS-ONR—24). NTIS, PC A02/MF A01.

Pub. in Physical Review B, Vol. 36, No. 13, 7252-7255(1 Nov 1987). Supersedes AD-A196 734.

Direct evidence is presented of the importance of the electron-phonon interaction in pure La_2CuO_4. Photoinduced ir-active vibrational modes (IRAV) and associated bleaching of the La_2CuO_4 phonon modes are observed in the spectral range below 700/cm. The observation of photoinduced IRAV modes implies the existence of structural deformation around the photoexcited carriers, indicative of coupling of the photoexcitations to the lattice. In addition, a broad photoinduced absorption is found that peaks at about 0.5 eV, indicating an electronic transition deep within the energy gap.

11368 (BARC—1386) Migration of cerium in mixed (Th,Ce) oxides under temperature gradient. Paul, A.R.; Naik, M.C.; Venkateswarlu, K.S. (Bhabha Atomic Research Centre, Bombay (India). Water Chemistry Div.). (Bhabha Atomic Research Centre, Bombay (India)). 1987. 15p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704078/JAW.

Thermomigration of cerium has been studied in high density sintered pellets ({similar←to}92 per cent TD) of ThO/sub 2/ - 6 wt per cent CeO/sub 2/ and ThO/sub 29/ wt per cent CeO/sub 2/ which were subjected to a temperature gradient between 1700 and 2330 K ({similar←to}8x10/sup 4/K/m). Concentration redistribution of cerium after thermal treatment in the temperature gradient was determined by radioactive counting of /sup 141/Ce which was incorporated into the mixed oxide powder at the time of pellet preparation. The temperature gradient was found to cause extensive change in the initial homogeneous distribution of cerium. After long time of thermal anneal the concentration profile was found to exhibit well defined minimum and maximum. There was considerable loss of cerium from near the hot end of the pellet. The results have been analysed and discussed. (author). 20 refs., 4 figures.

11369 (BNL—41323) The influence of twinning in $YBa_2Cu_3O_7$ on positron annihilation parameters. Usmar, S.G.; Lynn, K.G.; Moodenbaugh, A.R.; Suenaga, M.; Sabatini, R.L. (Brookhaven National Lab., Upton, NY (USA)). 1988. Contract AC02-76CH00016. 3p. (CONF-8808122—14). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004518/JAW.

From 8. international conference on positron annihilation; Gent, Belgium (29 Aug 1988).

Positron annihilation spectroscopy has been applied to the study of the high temperature superconductor YBa_2Cu_3O/sub 7{minus}δ/; δ = 0.1. Both positron lifetime and Doppler line shape measurements have been completed. Initial experiments revealed a correlation between a decrease in the line shape parameter S and the superconducting transition temperatures (T/sub c/) of $YBa_2Cu_3O_7$ (T/sub c/ = 90 K) and YBa_2Cu_3O/sub 6.6/ (T/sub c/ = 46 K). In $YBa_2Cu_3O_7$ the positron lifetime was also found to decrease at and below T/sub c/. More recent work revealed a different temperature dependence for the Doppler line shape parameter S. The physical origin of these samples dependent differences and their relevance to superconductivity is under investigation. Preliminary work suggest the differences be related to crystal twinning. 11 refs., 2 figs., 3 tabs.

11370 (CEA-N—2548(F)) Data and properties of lithium aluminate γ LiAl0/sub /2. Denuziere, C.; Roux, N. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Physico-Chimie). Jan 1988. 121p. (In French). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88756233/JAW.

In this report are gathered and analysed the literature data until July 1st, 1984, concerning the properties of lithium aluminate γ LiAl0/sub /2 relevant for the investigation of this compound as a tritium breeding material for a fusion reactor blanket. 67 refs.

11371 (CONF-881155—31) Properties of electrolyte and electrode films prepared by rf and dc magnetron sputtering. Bates, J.B.; Dudney, N.J.; Chu, Y.T.; Mazumdar, P. (Oak Ridge National Lab., TN (USA)). Dec 1988. Contract AC05-84OR21400. 7p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005123/JAW.

From Fall meeting of the Materials Research Society; Boston, MA, USA (28 Nov 1988).

Increased interest in ion conducting thin films and thin-film devices is evidenced by the number of papers on this topic presented at the recent Garmisch conference. Magnetically enhanced (magnetron) sputtering is an important technique for depositing these as well as other kinds of ceramic thin films. Two advantages of magnetron over conventional diode sputtering are the increased sputtering rate, which is important in the deposition of ceramic materials, and the reduction in electron bombardment of the substrate and growing film. In this paper, we describe our high-vacuum film growth chamber and present the results of tests of this system in fabricating films of lithium ion conducting glass electrolytes, TiS_2, and vanadium oxide by reactive dc and rf magnetron sputtering. The results of combining these films into a thin film lithium battery also are discussed. 22 refs., 1 tab.

11372 (CONF-881207—1) Whisker reinforced ceramics: Toughening behavior and properties. Becher, P.F.; Angelini, P.; Hsueh, Chun-Way; Tiegs, T.N. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 28p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004181/JAW.

From 7. international symposium on ceramics; Bologna, Italy (14 Dec 1988).

Several whisker reinforced ceramics exhibit considerably enhanced toughness which is derived from strong bridging whiskers in the crack tip region. Theoretical analyses of crack bridging by whiskers shows that the composite's toughness increases with whisker strength, radius, and volume content, the ratio of the fracture energy of the matrix to that of the whisker-matrix interface, and the ratio of the Young's modulus of the composite to that of the whisker. These features have been confirmed by a variety of experimental results. The observed lack of a temperature dependence for the toughness suggests whisker reinforcement as a most effective means of toughening ceramics. Also in comparison to equiaxed and plate like particles, toughening by whisker additions exhibit both greater fracture toughness and strength. Finally as compared to monolithic ceramics, various other mechanical properties are also significantly improved in the whisker reinforced ceramics. 39 refs., 7 figs.

11373 (CONF-8808170—1) Calculations of the thermodynamic properties of metallurgical solutions. Blander, M. (Argonne National Lab., IL (USA)). 1988. Contract W-31109-ENG-38. 13p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89003664/JAW.

From 27. annual conference of metallurgists; Montreal, Canada (28 Aug 1988).

Predictive theories for metallurgical solutions are important precursors for computer software in chemical and extractive metallurgy. A limited selection of concepts useful for slags and other ionic systems will be discussed, and include the quasichemical theory, the conformal ionic solution theory, and polymer theory. We emphasize theories which usefully predict solution properties of multicomponent ionic systems, such as silicates and molten salts, to illustrate the range of possible uses. 21 refs., 5 figs.

11374 **(CONF-8811129—1) Shielding effectiveness of superconductive particles in plastics.** Pienkowski, T.; Kincaid, J.; Lanagan, M.T.; Poeppel, R.B.; Dusek, J.T.; Shi, D.; Goretta, K.C. (Argonne National Lab., IL (USA)). Sep 1988. Contract W-31109-ENG-38. 6p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89003888/JAW.

From Wire and cable symposium; Reno, NV, USA (15 Nov 1988).

The ability to cool superconductors with liquid nitrogen instead of liquid helium has opened the door to a wide range of research. The well known Meissner effect, which states superconductors are perfectly diamagnetic, suggests shielding applications. One of the drawbacks to the new ceramic superconductors is the brittleness of the finished material. Because of this drawback, any application which required flexibility (e.g., wire and cable) would be impractical. Therefore, this paper presents the results of a preliminary investigation into the shielding effectiveness of YBa_2Cu_3O/sub 7-x/ both as a composite and as a monolithic material. Shielding effectiveness was measured using two separate test methods. One tested the magnetic (near field) shielding, and the other tested the electromagnetic (far field) shielding. No shielding was seen in the near field measurements on the composite samples, and only one heavily loaded sample showed some shielding in the far field. The monolithic samples showed a large amount of magnetic shielding. 5 refs., 5 figs.

11375 **(DOE/ER/45252—T3) [The mechanical behavior of surface modified ceramics]: Progress report.** Green, D.J. (Pennsylvania State Univ., University Park (USA)). [1988]. Contract FG02-86ER45252. 6p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004764/JAW.

This paper discusses the following topics: influence of surface residual stresses on strength variability; indentation of ion- exchanged glass; mechanical behavior of surface-modified alumina; and residual surface stress characterization. (LSP)

11376 **(DOE/ER/45302—1) Microchemical and microstructural studies of ceramic superplasticity: Progress report, May 1, 1988--December 1, 1988.** Chen, I-Wei. (Michigan Univ., Ann Arbor (USA). Dept. of Materials Science and Engineering). 1 Dec 1988. Contract FG02-87ER45302. 17p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005148/JAW.

This paper discusses the following topics: superplasticity of zirconia-mullite composites and hot deformation characteristics of YBa_2Cu_3O/sub x/ and $Bi_2(Sr,Ca)_3Cu_2O$/sub x/. 11 figs., 1 tabs. (LSP)

11377 **(DOE/ER/45341—1) Protons and lattice defects in perovskite-related oxides: Progress report, January 1--September 15, 1988.** Nowick, A.S. (Columbia Univ., New York (USA). Henry Krumb School of Mines). 1988. Contract FG02-88ER45341. 5p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004121/JAW.

Much of the work on protons and defects in doped $KTaO_3$ has been completed, and similarly for the study of protonic conduction in $SrCeO_3$:Yb^{3+}. The work on high T/sub c/ superconductors has explored the role of hydrogen. Two papers are appended: one on $SrCeO_3$, the other an overview of diffusion in oxides that has developed some novel concepts.

11378 **(EGG-M—88094) Elastic hysteresis phenomena in ULE and Zerodur optical glasses at elevated temperatures.** Wilkins, S.C.; Coon, D.N.; Epstein, J.S. (EG and G Idaho, Inc., Idaho Falls (USA)). 1988. Contract AC07-76ID01570. 7p. (CONF-880887—28). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005183/JAW.

From 32. international technical symposium on optical and opto-electronic applied sciences and engineering; San Diego, CA, USA (14 Aug 1988).

Elastic hysteresis phenomena were observed in ULE and Zerodur glasses at elevated temperatures up to glass transition. These effects were found under load deformation testing using four-point bending. Permanent creep resulted in Zerodur at 900{degree}C and in ULE at 1000{degree}C. The deformation was monitored at mid-span of the samples with a capacitance-type transducer having 0.01 micrometer resolution. These hysteresis effects may be classified as elastic bimodulus between loading and unloading; that is, two different elastic moduli were observed between loading and unloading. Upon complete unloading, a minimal deformation state promptly returned, indicating little or no viscoelastic creep. The hysteresis effect may be attributed to a change in glass structure as a function of stress state. A description of the test apparatus and procedure, test results for both glasses at several elevated temperatures, and an elementary discussion of continuum theory of constitutive behavior are included. 6 refs., 9 figs.

11379 **(INIS-BR—1341) Zirconia-magnesia solid electrolytes for measurements of oxygen activity.** Muccillo, R. (Associacao Brasileira de Ceramica, Sao Paulo, SP). 1986. 12p. (In Portuguese). (CONF-8604394—).

From 30. Brazilian congress on ceramic; Rio de Janeiro, Brazil (1 Apr 1986).

Powder processing and conformation, sintering, X-ray diffractometry and electrical conductivity studies have been carried out in ZrO/sub 2/:x%MgO ($0 < x < 5$) to determine the ideal composition of ceramic zirconia-magnesia solid electrolyte for the fabrication of oxygen monitors. Samples with density values close to 92% TD have been obtained. XRD and ionic conductivity data have been determined both in our samples as well as in the solid electrolytes of commercial oxygen sensors, for comparison purposes. All the components of an oxygen sensor which include the solid electrolyte, the reference electrode, the counter electrode, the ceramic body, the electrical leads and the extension cable, have been designed for laboratory tests. Sensor prototypes have been set up for the determination of the oxygen content in molten steels.

11380 **(KFK—4469) Thermal shock strength of multiphase materials.** Jauch, U. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Material- und Festkoerperforschung; Technische Hochschule Aachen (Germany, F.R.)). Oct 1988. 156p. (In German). NTIS (US Sales Only), PC A08/MF A01. Order Number DE88756517/JAW.

Ceramic materials show in contrast to metals no tolerant behaviour in a changing temperature field. That means that a thermal shock by quenching from a certain temperature leads to damage of the material. The degree of damage depends on the sort of temperature field and other conditions. The properties, which describe the maximum temperature difference depend on the structure of the material. That means it is possible to describe the property specific behaviour as a function of the structure. Therefore one is able to conceive theoretically a material with randomly variable thermal shock behaviour. Investigations were taken out with porous ceramics and ceramics with dispersed metal phases. The influence of the dispersed phase on the material properties was examined experimentally as well as in a theoretical way, using the so called model concept. On the basis of the calculated data with different theoretical approaches, the thermal shock strength in dependence on the concentration of the dispersed phase was calculated and compared with experimental values. Good agreement was found between theoretical and experimental results.

11381 **(LBL—23631) In-situ spectroscopic studies of electrochromic hydrated nickel oxide films.** Yu, P.C.; Lampert, C.M. (Lawrence Berkeley Lab., CA (USA)). Jun 1987. Contract AC03-76SF00098. 14p. (CONF-8708110—41). NTIS, PC A03/MF A01 - OSTI. Order Number DE89004691/JAW.

From 31. SPIE annual international technical symposium on optical and optoelectronic applied science and engineering; San Diego, CA, USA (16 Aug 1987).

In this investigation, in-situ spectroscopic studies of anodically deposited electrochromic hydrated nickel oxide electrodes were performed by visible/near-infrared spectroscopy and Fourier-Transform Infrared (FTIR) spectroscopy. All measurements were taken while the nickel oxide thin films were switching between the bleached and colored states, where the electrodes were not removed from the electrochemical cell. Optical transmittance measurements of the nickel oxide film relative to tin oxide coated glass varied during coloring from the integrated solar spectral transmittance, T/sub s/ = 101% - 54%, and average near-infrared transmit-

tance, T/sub nir/ = 101% - 83%. The photopic transmission was T/sub p/ = 101% - 31%. Transmittance measurements versus time were also performed at selected wavelength values, ranging from 375 to 1100 nm. Also, different scan rates (10--100 mV/s) were investigated at each of these wavelengths, where optimum switching rates could be determined. All changes in optical density were achieved by continuously cycling between a potential range of -500 to +800 mV. Coloration occurs at a faster rate than bleaching of the films at every switching rate selected. Also, maximum and minimum transmission measurements at 420 nm do not correspond to the cathodic and anodic peak current densities. Instead, these transmission measurements correspond to the regions past the peak current densities. From these optical experiments, plots of transmission (%) versus voltage (mV) and transmission (%) versus total extracted charge (mC) were obtained. 20 refs., 12 figs., 2 tabs.

11382 (LBL—26211) Application of controlled interfacial pore structures to pore perturbation and pore drag in alumina. Roedel, J.W. (Lawrence Berkeley Lab., CA (USA)). Nov 1986. Contract AC03-76SF00098. 233p. NTIS, PC A11/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004586/JAW.

A new technique has been developed which allows generation of intergranular pore structures with pores of almost any size, spacing, shape and number. This method is based on photolithographic techniques, ion beam etching and hot pressing. The material studied is alumina; the purpose of the investigation is a simulation of various aspects of sintering. If an etched sapphire wafer is bonded to an unetched sapphire disk, bicrystals with well-defined pore geometries are produced. These samples are utilized to monitor the evolution of initially instable pore structures such as pore channels and flat cracks. The behavior of these features is found to depend strongly on the crystallographic orientation of the bonding plane, and in the case of pore channels, also depends strongly on the channel direction. As a byproduct, metastable and stable faceted pore geometries as a function of orientation in the bicrystal can be monitored. If an etched sapphire wafer is bonded to a dense polycrystalline matrix (undoped and MgO-doped alumina), grain growth under the influence of pore drag can be studied. In the same experiment, the conditions for pore-boundary separation can be defined. Grain growth in a dense matrix and grain boundary migration of basal plane sapphire into alumina have been measured. The applicability of this method to pore coarsening and pore elimination has been shown. 145 refs., 83 refs., 4 tabs.

11383 (ORNL/TM—11002) High Temperature Materials Laboratory first annual report: June 1987 through September 1988. Tennery, V.J.; Foust, F.M. (Oak Ridge National Lab., TN (USA)). Dec 1988. Contract AC05-84OR21400. 16p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89005296/JAW.

The High Temperature Materials Laboratory, a DOE-designated national user facility at the Oak Ridge National Laboratory, became operational in June 1987. User research in the four User Centers has steadily increased since the first standard user agreement was signed in July 1987. To date, 17 universities and 11 industrial companies have signed agreements to utilize the facility, and 45 research proposals have been approved. 5 figs.

11384 (PB—89-116685/XAB) Optical properties of Y-Ba-Cu-O: an ellipsometric study. Bjoerneklett; Borg; Hunderi; Julsrud. (Selskapet for Industriell og Teknisk Forskning, Trondheim (Norway)). 23 Jun 1988. 8p. (STF—19-A88006). NTIS, PC E03/MF E03.

The optical properties of $YBa_2Cu_3O_7$ were studied in the range 0.5 to 4.0 eV by spectrometric ellipsometry. The spectrum is characterized by a dominant parallel band like absorption at 0.5 eV with onsets of normal interband absorptions at 1.93 and 3.4 eV. These peaks show only weak shifts with temperature.

11385 (PB—89-116693/XAB) AC-susceptibility measurements on superconducting T1-Ba-Ca-CuO samples. Gjoelmesli; Nes; Laegreid; Vassenden; Fossheim. (Selskapet for Industriell og Teknisk Forskning, Trondheim (Norway)). 21 Jun 1988. 14p. (STF—19-A88005). NTIS, PC E03/MF E03.

Resistance and AC-susceptibility measurements in zero and nonzero (about 0.2T) static magnetic field are presented for T1-Ba-Ca-CuO (1) samples of different composition. Scanning electron microscopy images of the material are shown. A simple self-inductance method for uncalibrated AC susceptibility measurements is described.

11386 (RISO-M—2675) Mechanical properties and microstructure of zirconia toughened alumina. Maschio, S.; Toft Soerensen, O. (Risoe National Lab., Roskilde (Denmark)). Jan 1988. 18p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755845/JAW.

Powders of zirconia toughened alumina containing 15vol.% ZrO/sub 2/-non-stabilized as well as stabilized with 3mole% Y/sub 2/O/sub 3/ - were prepared using two techniques: hydrolysis of a ZrOCl/sub 2//sup ./8H/sub 2/O solution with or without addition of Y(NO/sub 3/)/sub 3//sup ./5H/sub 2/O followed by hydrolysis of Al-sulphate (here called "direct hydrolysis") and by hydrolysis of the Zr-Y-solution onto a commercial Al/sub 2/O/sub 3/ powder in a slurry. By both techniques it was possible to obtain powders which when sintered at 1600 deg. C gave specimens with reasonable good mechanical properties - median bend strength values in the range 326-346MPa and k/sub Ic/ values in the range of 4.2-5.16MPam/sup 1/2/. The highest k/sub Ic/ value was actually obtained with the powder prepared by hydrolysis of non-stabilized zirconia in the Al/sub 2/O/sub 3/-slurry, which after sintering, however, only contained 20vol.% t-ZrO/sub 2/. From this observation it is concluded that microcracking is the controlling mechanism for fracture toughness in contrast to transformation toughening which is believed to control the bend strength. Finally, SEM micrographs on polished and thermally etched sintered surfaces showed that these specimens were very fine grained (mean grain size {similar←to}0.3mm) with an even distribution of the zirconia grains in the Al/sub 2/O/sub 3/-matrix.

11387 (RISO-M—2681) Determination of Young's modulus by Knoop indentation measurements. Ali, M.E.S.; Toft Soerensen, O. (Risoe National Lab., Roskilde (Denmark)). Jan 1988. 17p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755846/JAW.

Marshall, Noma and Evans (1) proposed a simple method for measurements of Young's modulus by the Knoop identation technique. In order to obtain reliable data by this technique, however, it is necessary that the indenter is very carefully aligned in order to obtain perfectly symmetrical impressions. In the present work a correction method is proposed by which accurate results can be obtained even on asymmetrical impressions which is usually obtained. By measurements on various zirconia toughened ceramic materials it is demonstrated that the E-values obtained using this correction method are very similar to literature data determined by other techniques.

11388 (RISO-M—2682) Effect of cutting on fracture strength of yttria partially stabilized zirconia. Ali, M.E.S.; Toft Soerensen, O. (Risoe National Lab., Roskilde (Denmark)). Jan 1988. 33p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755847/JAW.

Yttria partially stabilized zirconia (YPSZ) is an interesting construction material which can be produced both with a high fracture strength and with a good fracture toughness. For this material as well as for other ceramic materials the properties of the final specimens not only depend on the composition and the preparation conditions (pressing mode, sintering temperature etc.), but also on the surface characteristics. In a previous work it was observed that cutting followed by polishing gave a considerable increase in the fracture strength. In this work the effect of cutting as well as the influence of the pressing mode is examined in greater detail. From the results obtained it is concluded that cutting of one or two surfaces of the test specimens indeed produces a large increase in the fracture strength - after sintering the strength was about 550MPa whereas the strength was increased to 823MPa when both the surface under compression and tension in 4-point bend testing was prepared by cutting. By mechanism responsible for this surface strengthening is considered to be domain reorientation of the tetragonal phase. 19 tabs., 10 ills.

11389 **(RISO-M—2711) Ultrasonic examination of ceramics and composites for porosities in an automatic scanning system.** Gundtoft, H.E. (Risoe National Lab., Roskilde (Denmark)). May 1988. 15p. (CONF-8709161—1). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755848/JAW.

From 4. European conference on non-destructive testing; London, UK (13 Sep 1987).

Using a very precise scanning system and computer evaluation, we can get quantitative results from automatic ultrasonic examination. In this paper two examples dealing with nonmetallic materials are presented. In a ceramic plate (>1 inch thick) small spherical prorosities (down to 0.1 mm) would harm the final product. Several artificial defects made in the plate were used for calibration and optimisation of the technique. Areas with with a microscope. Good agreement with the predicted values from the ultrasonic examination was found. From the NDT-examination the exact position of a porosity is known in all 3 coordinates (x, y and z). The size of the defect can also be measured. A single porosity with a diameter of 0.1 mm can be detected. Carbon-reinforced composites were examined. 8 prepregs were stacked and hardened in an autoclave to form a sheet (1 mm thick). Air trapped in the material resulted in porosities in the final product. A double trough transmission-scanning technique was used for the examination. The porosity percentages were determined by the NDT-technique, and agreement with destructivly determined values on samples from the same sheet was found.

11390 **(SAND—88-2248C) Radiation-hardened MOS device response to high dose rate irradiations as a function of temperature.** Sexton, F.W.; Schwank, J.R.; Kohler, R.A. (Sandia National Labs., Albuquerque, NM (USA)). 1989. Contract AC04-76DP00789. 5p. (CONF-890212—2). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE88015258/JAW.

From HEART conference; Melbourne, FL, USA (7 Feb 1989).

The effect of the device temperature during irradiation at high dose rates has been investigated for transistors and ICs over the MIL-STD temperature range, -55 to 125{degree}C. At low temperatures, large increases in transistor leakage current was observed due to large shifts in the threshold voltages of parasitic field oxide transistors. The response of hardened field oxide devices and their effects on IC performance at high dose rates and low temperatures will be discussed for several different process conditions. 7 refs., 3 figs.

11391 **(SAND—88-2957C) Pore structure characterization of catalyst supports via low field NMR.** Smith, D.M.; Glaves, C.L.; Gallegos, D.P.; Brinker, C.J. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 12p. (CONF-880912—20). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004826/JAW.

From 196. American Chemical Society national meeting; Los Angeles, CA, USA (25 Sep 1988).

In this paper, the application of low-field NMR to both surface area and pore structure analysis of catalyst supports will be presented. Low-field (20 MHz) spin-lattice relaxation (T_1) experiments are performed on fluids contained in alumina and silica catalyst supports. Pore size distributions (PSD) calculated from these NMR experiments are compared to those obtained from mercury porosimetry and nitrogen condensation. 18 refs., 4 figs., 2 tabs.

11392 **(UCRL—98899) Defect properties of high temperature superconductors probed by positrons.** Jean, Y.C.; Nakaniski, H.; Turchi, P.E.A.; Howell, R.H.; Wachs, A.L.; Fluss, M.J.; Meng, R.L.; Hor, P.H.; Huang, Z.J.; Chu, C.W. (Lawrence Livermore National Lab., CA (USA)). Dec 1988. Contract W-7405-ENG-48. 5p. (CONF-881155—3). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005354/JAW.

From Fall meeting of the Materials Research Society; Boston, MA, USA (28 Nov 1988).

Measurements of electron momentum density by positron annihilation are influenced by the presence of defects in superconducting oxides. Both lifetime and Doppler broadening measurements are sensitive to the superconducting transition. Possible candidates for the defect species are discussed along with their role in modifying the positron response. 16 refs., 2 figs.

11393 **(UCRL—99378) Interfacial bonding in W/C and W/B_4C multilayers.** Jankowski, A.F.; Schrawyer, L.R.; Wall, M.A.; Craig, W.W.; Morales, R.I.; Makowiecki, D.M. (Lawrence Livermore National Lab., CA (USA)). Oct 1988. Contract W-7405-ENG-48. 17p. (CONF-8810230—1). NTIS, PC A03/MF A01 - OSTI. Order Number DE89002931/JAW.

From Topical conference on probing the nanometer scale properties of surfaces and interfaces; Atlanta, GA, USA (3 Oct 1988).

The nature of carbon bonding in W/C and W/B_4C multilayer structures is investigated by Auger electron spectroscopy (AES). The interfacial roughness in these x-ray mirrors directly affects their use as efficient optical elements. A significant contribution to interfacial roughness is the possible presence of second phases, WC in particular for the W/C and W/B_4C combinations. AES depth profiling of the multilayer interfaces is used as a direct method to probe for the existence of WC. 8 refs., 4 figs.

11394 **Effect of stoichiometry and post-annealing conditions on magnetron sputtered films of $YBa_2Cu_3O_7$ on cubic zirconia.** Wiesmann, H.; Chen, D.H.; Sabatini, R.L.; Hurst, J.; Ochab, J.; Ruckman, M.W. (Department of Applied Science, Brookhaven National Laboratory, Upton, New York 11973). *Journal of Applied Physics;* **65**: No. 4, 1644-1647(15 Feb 1989).

High-quality $YBa_2Cu_3O_7$ films supported on yttrium stabilized cubic zirconia were made by simultaneous reactive magnetron sputtering using yttrium, barium, and copper metal targets. Superconductivity onsets of 92 K with transition widths of 1.5 K (10%—90%) have been achieved on yttrium stabilized cubic zirconia substrates. Various aspects of the deposition processes are described and the effect of deposition parameters and post-annealing on thin-film stoichiometry, structure, and superconducting properties is discussed.

11395 **Low-resistivity, $YBa_2Cu_3O_7$-to-silver electrical contacts by plasma spraying.** Katz, J.D.; Willis, J.O.; Maley, M.P.; Castro, R.G. (Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Journal of Applied Physics;* **65**: No. 4, 1792-1794(15 Feb 1989).

A simple cost-effective method has been developed for the fabrication of low-resistivity contacts for high-temperature superconducting ceramics. Surface resistivities have been measured for the contacts in the 10/sup -8/ Ω cm^2 range at 76 K. The fabrication method involves application of a silver pad to the ceramic by plasma spraying and then attachment of leads by soldering.

11396 **Ferroelectric-like phase transition at about 320 K and crystal growth of tungsten-bronze-type $Na_{13}Nb_{35}O_{94}$.** Abrahams, S.C.; Brandle, C.D.; Berkstresser, G.W.; O'Bryan, H.M.; Bair, H.E.; Gallagher, P.K.; Drotning, W.D. (AT & T Bell Laboratories, Murray Hill, New Jersey 07974). *Journal of Applied Physics;* **65**: No. 4, 1797-1799(15 Feb 1989).

The atomic coordinates of tungsten-bronze-type $Na_{13}Nb_{35}O_{94}$, determined by Craig and Stephenson [J. Solid State Chem. 3, 89 (1971)], are characteristic of one-dimensional ferroelectric crystals. The transition temperature from the ferroelectric-like to the hypothetical paraelectric phase is predicted to be about 340 K, on the basis of these room-temperature atomic coordinates. Calorimetric and dilatometric measurements indicate a gradual transition that is complete on heating by about 320 K. Dielectric permittivity and loss measurements exhibit broad but minor anomalies at about 340 K over the frequency range 0.4—100 kHz. The dielectric loss at 10 kHz is very low, at 0.0035. The spontaneous polarization is predicted to be about 0.3 C m^{-2}. Crystals with maximum dimensions of 2 cm in diameter by 5 cm in length along the c axis have been grown.

11397 **Positive muon in the intermetallic hydride ZrV_2H/sub x/: A muon tracer study supplemented by differential thermoanalysis, neutron vibrational spectroscopy, and quasielastic neutron scattering.** Hempelmann, R.; Richter, D.; Hartmann, O.; Karlsson, E.; Wa€¸pling, R. (Los Alamos Neutron Scattering Center, Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Journal of Chemical Physics;* **90**: No. 3, 1935-1949(1 Feb 1989).

ZrV_2 is an intermetallic compound with energetically different interstitial sites, which upon hydrogenation are successively filled with hydrogen (thermodynamic distribution). When a positive muon is added as a microscopic probe, it is thermalized at random and thus at low temperatures statistically distributed over the available (unblocked) interstices. By varying the preloading we scan the accessible hydrogen sites and find that at high hydrogen content three kinds of interstices are occupied, in contradiction to literature diffraction data. This surprising result is confirmed by a detailed neutron vibrational spectroscopy study on ZrV_2H/sub x/ which is presented as well. The temperature dependence of the μ^+ relaxation rate is textbook-like in empty ZrV_2: static muon at $T<50$ K, complete motional narrowing at $T>200$ K. In ZrV_2H/sub x/, however, the relaxation rate exhibits an intermediate plateau which we attribute to a relocation of the muon. The motion of the muon above 150 K is interpreted as being directly related to the hydrogen diffusion which we have separately measured by means of quasielastic neutron scattering. In addition, we investigated the ZrV_2/H phase diagram by differential thermoanalysis.

11398 **High-resolution photoemission study of the low-energy excitations reflecting the superconducting state of Bi-Sr-Ca-Cu-O single crystals.** Imer, J.; Patthey, F.; Dardel, B.; Schneider, W.; Baer, Y.; Petroff, Y.; Zettl, A. (Institut de Physique, Universite de Neucha-italic-circumflextel, CH-2000 Neucha-italic-circumflextel, Suisse). *Physical Review Letters;* **62**: No. 3, 336-339(16 Jan 1989).

uv-photoemission spectra ($h\nu = 21.2$ eV) of single-crystal specimens of the high-T/sub c/ superconductor $Bi_2Sr_2CaCu_2O_8$ have been measured with a resolution of 20 meV in the normal state at 105 K and in the superconducting state at 15 K. In a narrow energy range of 120 meV below the Fermi energy, the low-temperature spectra reveal unambiguously the low-lying quasiparticle excitations reflecting the superconducting state. A straight forward analysis of these spectra provides a strong evidence for the existence of a superconducting gap with a reduced value 2Δ/k/sub B/T/sub c/$\cong 8$.

11399 **Atomic arrangement and electronic structure of BC_2N.** Liu, A.Y.; Wentzcovitch, R.M.; Cohen, M.L. (Department of Physics, University of California, Berkeley, California 94720). *Physical Review* [*Section*] *B: Condensed Matter;* **39**: No. 3, 1760-1765(15 Jan 1989).

The results of a pseudopotential local-orbital calculation on the recently synthesized hybrid of graphite and hexagonal BN, BC_2N, are presented. Three possible atomic arrangements in the BC_2N monolayer, representing a variety of nearest-neighbor environments, are studied. For the monolayer structures considered, the one which maximizes chemical bond strength has the lowest total energy. The electronic structures of the three models are also investigated, and a correlation between the structural symmetries and the conducting properties of the models is found. In particular, the two structures which lack inversion symmetry are found to have semiconducting gaps, while the one with inversion symmetry is found to be metallic. This behavior is similar to the relation of graphite to BN. Of the inspected structures, the one with the lowest energy displays a local-density-approximation (LDA) gap of about 1.6 eV, which is expected to decrease upon stacking of the semiconducting monolayers.

11400 **Defect structure in transition-metal monoxides.** Khowash, P.K.; Ellis, D.E. (Department of Physics and Astronomy, Northwestern University, Evanston, Illinois 60208). *Physical Review* [*Section*] *B: Condensed Matter;* **39**: No. 3, 1908-1913(15 Jan 1989).

The electronic structure and stabilization energy of metal vacancy and vacancy-interstitial clusters are studied in transition-metal monoxides using the first-principles local-density theory. The discrete-variational method in the embedded-cluster scheme is used to obtain both the one-electron properties and cohesive energies. Our calculations predict greater stability for 2:1 (vacancy:interstitial) defect structure over simple vacancies. This is in agreement with experiments for MnO and the heavier 3d compounds, but for TiO and VO lattice vacancies at the metallic or oxygen sites are experimentally predominant. The energy for the single metal vacancy is calculated to be close to the 2:1 defect energy, and so cluster-size effects and computational limitations need to be considered further. For FeO and CoO, however, the 4:1 interstitial complex is found to be more stable than other simple defects, in accord with experiment. The probability of formation of 4:1 clusters and their aggregates in TiO and MnO is explored; the interstitial metal ion tends to be in a trivalent state as previously determined for FeO and CoO.

3606 Other Materials

REFER ALSO TO CITATION(S) 10626, 10695, 10911, 11030, 11030, 11146, 11322, 11328, 11389, 11488, 11494, 11503, 11520, 11525, 11538, 11578, 11585, 11689, 11948, 12334, 12341, 12348, 12349

11401 **(AD-A—198030/9/XAB) Mechanisms of radiation damage generated by ionizing radiation in optical waveguides. Final report, 1 June 1984-31 December 1987.** Schwartz, R.N. (Hughes Research Labs., Malibu, CA (USA)). Sep 1988. 116p. (HAC-REF-F—7182). NTIS, PC A06/MF A01.

Radiation damage generated by ionizing radiation (uv- and gamma radiation) was studied in a variety of optical preforms and fiber-optic waveguides. The materials investigated included germanium-doped silica preforms and fibers, fluorine-doped silica, and heavy-metal fluoride glass. Radiation damage and aging effects in bulk and fiber were also investigated. Electron paramagnetic resonance and optical spectroscopies were used to study the centers generated by the ionizing radiation. A parallel study of the intrinsic bonding defects in SiO_2 films grown by a variety of techniques was also carried out.

11402 **(AD-A—198421/0/XAB) MBE growth, characterization, and electronic-device processing of HgCdTe, HgZnTe, related heterojunctions, and HgCdTe-CdTe superlattices. Semiannual technical report.** Faurie, J.P. (Sunflower Army Ammunition Plant, Lawrence, KS (USA)). 30 Jun 1987. 63p. NTIS, PC A04/MF A01.

The author reports on growth and characterization of high-quality HgCdTe grown on CdTe, CdZnTe, CdTeSi, and GaAs substrate. A p-type layer grown on a two-inch diameter GaAs (100) substrate exhibiting an excellent uniformity in composition was also grown. Extrinsic dopants such as In, As, Sb and Li were investigated and heterojunctions were grown in situ. Incorporation of mercury in CdTe layers during the growth of HgTe-CdTe superlattices is also reported.

11403 **(AD-A—198626/4/XAB) Fundamentals of interfacial strength in composite materials. Annual report No. 1, 1 July 1986-30 September 1987.** Thompson, A.W.; Bernstein, I.M.; Voelkel, A. (Carnegie-Mellon Univ., Pittsburgh, PA (USA). Dept. of Metallurgical Engineering and Materials Science). 16 Nov 1987. 22p. (MEMS-ALC—11). NTIS, PC A03/MF A01.

This research period emphasized 6061 and 7090 aluminum alloys as composite matrices, both with particle SiC reinforcements. As in their previous work, the authors found the fracture behavior to be sensitive to both process variables (in this case, different consolidation methods by the two material producers) and to metallurgical variables (in this case, degree of aging). In particular, overaging these materials lead to precipitation at the interface between the matrix and the SiC, which in turn appears to encourage initiation and growth of microvoids at those interfaces, leading to enhanced ductile fracture.

11404 **(AD-A—198763/5/XAB) Spallation and dynamic fracture as an effect of laser-induced shock waves. Interim report No. 3. January-June 1988.** Gilath, I.; Eliezer, S. (Ecole Nationale Superieure des Mines, 42 - Saint-Etienne (France)). 22 Jun 1988. 18p. NTIS, PC A03/MF A01.

A high-irradiance single-beam short-pulsed Nd:glass laser was used to generate shock waves in 2D carbon-carbon composites. Dynamic brittle fracture at ultrahigh strain rate was observed as a result of reflected shock waves as tensile waves from the back surface of samples. Successive stages of damage from incipient spallation to complete sample perforation were obtained by increasing gradually the laser energy. The thermomechanical damage on the front surface as a result of laser interaction with the target material, and the mechanical damage at the back surface as a result of shock-wave reflection were characterized by optical and scanning electron microscopy. The failure properties of the composites were related to the processing of densification and graphitization mode.

11405 **(CONF-880623—2) A molecular dynamics study of superionic Ag_2Se.** Rino, J.P.; Hornos, Y.M.M.; Antonio, G.A.; Ebbsjo, I.; Kalia, R.K.; Vashishta, P. (Argonne National Lab., IL (USA)). Sep 1988. Contract W-31109-ENG-38. 21p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004207/JAW.

From 11. symposium on the reactivity of solids; Princeton, NJ, USA (19 Jun 1988).

Structural and dynamical correlations in supersonic Ag_2Se are studied with the molecular dynamics method using an effective interatomic potential which incorporates the short-range repulsion, charge-dipole and the long-range Coulomb interactions. We focus on the behavior of the pair-correlation functions, partial static structure factors, the temperature dependence of the constant of self diffusion for Ag, and Haven's ratio. The results compare favorably with experimental measurements. 27 refs., 5 figs., 2 tabs.

11406 **(DOE/ER/13507—3) Synthesis and analysis of novel polymers with potential for providing both high permselectivity and permeability in gas separation applications: Progress report, December 1987--December 1988.** Koros, W.J.; Paul, D.R. (Texas Univ., Austin (USA). Dept. of Chemical Engineering). 28 Nov 1988. Contract FG05-86ER13507. 9p. NTIS, PC A02/MF A01 - OSTI. Order Number DE89004323/JAW.

We have achieved the following significant objectives: obtained all of the polycarbonate and polysulfone materials proposed for our study except the hexafluorotetramethyl polysulfone material, and plans are in place to synthesize this material; completed permeation and sorption characterization with a spectrum of gases in most of the originally proposed polycarbonate and polysulfone materials. These data allow separating the structure-property effects of thermodynamic factors (sorption) from kinetic factors (diffusivity); completed high pressure mixed gas permeation studies with CO_2 and CH_4 to help define the conditions where plasticization-induced loss in permselectivity are expected to be significant; obtained and tested additional polymers in these two classes of materials to further test general rules that have evolved to guide material selection for high performance gas separation membranes. 3 figs., 3 tabs.

11407 **(DOE/ER/13507—4) Synthesis and analysis of novel polymers with potential for providing both high permselectivity and permeability in gas separation applications: Summary technical report, April 1986--December 1988.** Koros, W.J.; Paul, D.R. (Texas Univ., Austin (USA). Dept. of Chemical Engineering). 7 Dec 1988. Contract FG05-86ER13507. 17p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004325/JAW.

We have gained significant insights into the basic principles governing sorption and transport in glassy materials. The following three important areas can be identified in which advances in the basic science controlling gas separation membrane operations were made. Extremely attractive new membrane materials have been identified. These materials will be compared to conventional materials to illustrate the value of the systematic structure- property approach. Two basic rules were formulated that provide improved guidance in selecting candidate materials for gas separation membranes. The permeability and permselectivity parameters mentioned below determine the productivity and the product purity, respectively, that can be achieved using a membrane material. Important preliminary insights into the process of plasticization of a series of structurally-related glassy polymers were achieved. Extensive experimental work involving three classes of polymers, the polycarbonates, the polyimides and the polysulfones have proven that the more restricted glassy environment provides a greater ability than that in rubbery materials to regulate the relative permeation rates of passage of gaseous penetrants that have only subtly different molecular sizes or shapes. 22 refs., 5 figs., 4 tabs.

11408 **(DOE/ER/45259—6) Band electronic structures and crystal packing forces: Progress report, July 1, 1986--December 19, 1988.** Whangbo, M.H. (North Carolina State Univ., Raleigh (USA). Dept. of Chemistry). 19 Dec 1988. Contract FG05-86ER45259. 20p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004938/JAW.

This report briefly summarizes our research progress achieved under the support of the DOE Grant (FG05-86ER45259) during the period of July 1, 1986 to December 19, 1988. Our research has been in close collaboration with Dr. Jack M. Williams's research group at Argonne National Laboratory, especially in the areas of organic conducting salts and high-temperature copper-oxide superconductors. We have examined the electronic structures of various organic conducting salts, high-temperature copper-oxide superconductors, and other low-dimensional materials by performing tight-binding band electronic structure calculations. We have carried out ab initio SCF-MO/MP2 calculations on model organic systems to study the packing forces associated with organic donor salts, and empirical atom-atom potential calculations to study the packing forces of the high-temperature copper-oxide superconductors. Our research efforts have led to a number of publications concerning the structural and the electronic properties of those low-dimensional solid materials.

11409 **(DOE/ID/12232—1-Pt.2) Energy efficient membrane processes for the separation of organic liquids: Part 2: Final report, September 28, 1982--December 31, 1986.** Cabasso, I.; Acharya, H.R.; Korngold, E.; Liu, Z.; Stern, S.A.; Li, W.; Makenzie, T.; Poda, E. (State Univ. of New York, Syracuse (USA). Coll. of Environmental Science and Forestry). Oct 1987. Contract AS07-82ID12232. 177p. NTIS, PC A09/MF A01 - OSTI; 1; GPO Dep. Order Number DE89002486/JAW.

The present report demonstrates the use of membrane technology for dehydration processes concentrating on two examples: azeotropic separation of isopropanol-water, and separation of ethanol-water mixtures (starting at 84.5 wt. % ethanol where separation by distillation begins to be progressively more energy intensive). The principles of the membrane separation processes employed in such separations were discussed in Part I of the report. The advantage of the membrane processes is that they do not require the addition of a third component and separation is a continuous process. Pervaporation, perstraction, and air-sweep pervaporation were thoroughly studied for these separations. An urgent need for the identification of the appropriate membrane was realized. This study has revealed that ion-exchange membranes are suited for these separations. Results are discussed. 9 refs., 68 figs., 33 tabs.

11410 **(IPEN-Pub—144) Thermoluminescence and optical absorption comparative studies with TLD-100 and pure LiF.** Rosa, L.A.R. da; Caldas, L.V.E. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo, SP (Brazil)). Jul 1988. 15p. (In Portuguese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704157/JAW.

Optical absorption (OA) studies were carried out with LiF: Mg, Ti (TLD-100) and pure LiF exposed to X radiation, 77.4 C.kg/sup -1/ (3 x 10/sup 5/ R) with the aim of relating the thermoluminescent (TL) peaks presented by TLD-100 to its intrinsic and irradiation defects. After a 280/sup 0/C thermal treatment for 15 minutes, an absorption band at 225 nm is observed in the TLD-100 OA spectrum. This band is not observed in the case of pure LiF. A correlation between TL peak 5 and the absorption band at 310 nm is established for TLD-100. These results agree with other publications and are explained.

11411 **(Juel—2214) Behaviour of candidate materials for fusion applications under high surface heat loads.** Bolt, H.; Nickel, H.; Kuroda, T.; Miyahara, A. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorwerkstoffe; Nagoya Univ. (Japan). Inst. of Plasma Physics). (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorwerkstoffe; Technische Hochschule Aachen (Germany, F.R.); Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorwerkstoffe; Nagoya Univ. (Japan). Inst. of Plasma Physics). Jul 1988. 142p. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88756511/JAW.

Dissertation submitted by T.H. Bolt.

High heat fluxes to in-vessel components of nuclear fusion devices (tokamaks) during normal operation and abnormal operation conditions are one of the governing issues in the selection of a plasma facing material and the design of first wall components. Their failure under high heat loads during service can severely influence the further operability of the entire fusion device. In order to determine the response of candidate materials to high heat fluxes an experimental program was carried out using the 10 MW Neutral Beam Injection Test Stand of the Institute for Plasma Physics of Nagoya University. Metal samples, 13 different fine grain graphites, carbon - carbon composites, and pyrolytic carbon samples were subjected to heat loads between 16 and 117 MW/m/sup 2/ and pulse durations of 50 to 950 ms. Afterwards the resulting structural changes as well as threshold values for the occurance of material damage were determined. The main damage observed on carbon materials was cracking in the case of graphites and pyrolytic carbon and erosion in the case of graphites and carbon - carbon composites. Processes leading to such damage were discussed and described in form of models. Parallel to these laboratory experiments numerical analyses of the response of graphite materials to high heat fluxes were carried out. The results are in general agreement with the experimentally determined values. In order to verify the results from experiments and numerical analyses, graphite test limiters were exposed to about 900 discharges in the JIPP T-IIU tokamak. These proof tests fully confirmed the results obtained.

11412 **(K/QT—225) Gas separation processes: Technology/business review.** Fain, D.E. (Oak Ridge Gaseous Diffusion Plant, TN (USA)). Oct 1988. Contract AC05-84OT21400. 25p. (CONF-8811117—1). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89002282/JAW.

From 6. annual membrane technology planning conference; Cambridge, MA, USA (1 Nov 1988).

A major problem in the commercialization of new membrane technology is that business executives and entrepreneurs in decision-making positions lack a practical understanding of how a membrane functions. Without this practical understanding, evaluating the risks and the amount and kind of work needed for the development effort is difficult. This paper begins bridging that information gap by discussing some of the models that can be used to provide a better understanding of the risks and some of the outstanding opportunities associated with membrane technology. An example of extensive research in membrane technology is the 40-year effort that has gone into the development and improvement of the barrier used in gaseous diffusion cascades to enrich uranium hexafluoride in the ^{235}U isotope. Most of the research applies to that specific separation process and is still classified. However, that body of work does provide insight into the physical and chemical mechanisms for gas separation processes. It has also provided insight into what kind of information is needed and what kind of data acquisition can provide that information. This paper discusses some of the insights acquired on how separation can occur and what data are lacking and the types of resources required to obtain them. 9 figs., 1 tab.

11413 **(KCP—613-4034) Evaluation of poly sheet resistivity.** Williams, M.F. (Allied-Signal Aerospace Co., Kansas City, MO (USA). Kansas City Div.). Dec 1988. Contract AC04-76DP00613. 24p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004437/JAW.

A large variation in poly sheet resistivity was seen on product over a period of three months. Sheet resistivity is controlled by the interaction between the ion implant and the furnace anneal which activates the implant. The anneal process was suspected to be at fault since the implant is tightly controlled. Variation between annealing furnace tubes and variation within tubes were both investigated as sources of the variation seen between production lots. A mechanical problem was determined to be the cause of the between-tube variation. It was repaired and a check procedure has been instituted to eliminate the possibility of recurrence. To reduce the within-tube variation, a process change was made to allow the product wafers to reach the desired temperature at the same time as the furnace tube. Previously, the furnace tube reached temperature and then the product wafers were inserted into the tube. This yielded a large time lag for the load wafers to reach the process temperature. Also considered in this report were the effects of timing between processes, the placement of wafers in the poly deposition stage, and the effects of the changed process on the radiation hardness of the device.

11414 (LA—11304-C, pp 1-29;) **Parylene chemistry and properties.** Liepins, R. May 1988. NTIS, PC A 17. Order Number DE88010660/JAW. (CONF-8710302—).

From JOWOG 28A; Los Alamos, NM, USA (6 Oct 1987).

The chemical and physical properties of parylene are discussed with particular attention to those properties relating to the deposition of coatings. The coating products produced are enumerated and evaluated.

11415 (LA—11304-C, pp 30) **Effect of annealing on liquid transport through Parylene C films.** Bradshaw, W.; Gunn, E.E. (Atomic Weapons Establishment, Aldermaston (England)). May 1988. NTIS, PC A 17. Order Number DE88010660/JAW. (CONF-8710302—).

From JOWOG 28A; Los Alamos, NM, USA (6 Oct 1987).

A simple quartz crystal microbalance has been used to investigate the effects of morphological changes, induced by aging treatments, on the sorption of K fluid by Parylene C films. Comparisons were made between aged and unaged films by exposing Parylene coated quartz crystals to an atmosphere containing K vapor, below its saturation vapor pressure, at temperatures below which significant aging occurred in the timescale of the experiment. Sorption levels and rates show that, following aging, the equilibrium uptake of K fluid is reduced; at the present time the precise effect on diffusion coefficient is unknown.

11416 (LA—11304-C, pp 31-35) **Vapor deposition of poly(paraxylylene) films: dependence of film thickness on position in coating chamber and on process factors.** Carley, J.F.; Lopez, L.A.; Spellman, G.P. (Lawrence Livermore National Lab., CA (USA)). May 1988. NTIS, PC A 17. Order Number DE88010660/JAW. (CONF-8710302—).

From JOWOG 28A; Los Alamos, NM, USA (6 Oct 1987).

Vacuum deposition of polyparaxylylylene (PPX, Parylene N) and kindred, chlorine-containing polymers has been practiced for about 20 years. The placement of many small targets throughout the chamber volume provides excellent definition of positional variation in coating thickness. Measuring thickness by mass changes of the targets is an accurate method for thicknesses of 0.2 mil (5 μm) and greater. With careful handling and a microbalance it might be extended below 1 + m.

11417 (LA—11304-C, pp 36-60) **Parylene ablation layer coating of mechanically non-supported inertial fusion targets.** Kim, H. (Laboratory for Laser Energetic, Rochester, NY (USA)). May 1988. NTIS, PC A 17. Order Number DE88010660/JAW. (CONF-8710302—).

From JOWOG 28A; Los Alamos, NM, USA (6 Oct 1987).

Ablation layers are deposited on DT-filled glass microballoon targets by a parylene coating scheme while the targets are bounced on the surface of a mechanical resonator. Optimum bouncing is achieved with the resonator surface moving with a peak vertical velocity of -3 cm/s at a frequency much greater than the bounce frequency of the targets. The resonator, a solid cylinder of high Q material, uses a longitudinal mode of vibration to achieve vertical motion, which is uniform over its surface. A flexural mode of the cylinder is used for dislodging targets which have become stuck. The adhesion of the targets due to charging is eliminated by creating a low power plasma in the bounding region. Real time

monitoring and control of coating thickness are achieved by use of a laser reflectometer. Examination of the coatings with electron microscopy and x-ray radiography shows a high degree of uniformity and smoothness. Homogeneous dispersion of high-Z elements in the ablation layer of the target have been achieved by coating halogenated parylene or alkali-ions of sulfonated polystyrene. In particular, ions of sulfopolystyrene provide the surface finish better than a few hundred angstroms.

11418 (LA—11304-C, pp 61) **Morphology of parylene C coatings.** Scarrow, R.K.; Gunn, E.E. (Atomic Weapons Establishment, Aldermaston (England)). May 1988. NTIS, PC A 17. Order Number DE88010660/JAW. (CONF-8710302—).

From JOWOG 28A; Los Alamos, NM, USA (6 Oct 1987).

The effect of annealing on the morphology of Parylene C coatings has been investigated using a number of techniques. The results of these studies suggest that the polymer is deposited in a metastable state in which the chains are parallel but conformationally disordered. No crystalline structure could be observed by X-ray analysis. Annealing allows the material to achieve a state of greater conformational order with the subsequent formation of crystalline regions. Heating the crystalline polymer above the melting temperature results in the formation of amorphous material.

11419 (LA—11304-C, pp 62-81) **Parylene coated microspheres: round-robin results.** Foreman, L.; Williams, J.M.; Espinoza, B.; Gomez, V.; Marsters, M.; Elliott, N.; Lagasse, R. May 1988. NTIS, PC A 17. Order Number DE88010660/JAW. (CONF-8710302—).

From JOWOG 28A; Los Alamos, NM, USA (6 Oct 1987).

A deposition system has been designed and developed for coating microspheres with parylene. Targets, coatings, and analyses are presented. The effects of varying operating parameters are demonstrated.

11420 (LA—11304-C, pp 82) **Developments in Parylene C coating of high explosives, part 1.** Thompson, D. (Atomic Weapons Establishment, Aldermaston (England)). May 1988. NTIS, PC A 17. Order Number DE88010660/JAW. (CONF-8710302—).

From JOWOG 28A; Los Alamos, NM, USA (6 Oct 1987).

Parylene C (polychloro-p-xylylene) coatings are used at Atomic Weapons Establishment (AWE) on high explosive components to act as a barrier against the migration of liquid ingredients, e.g. plasticizers, which may be detrimental to the performance of adjacent components. Parylene C is an excellent structural and barrier material that can be safely deposited under mild conditions and close control onto a variety of materials which by their nature are sensitive to high temperature and incompatibility with other coating materials.

11421 (LA—11304-C, pp 97-106) **Automated parylene coater for producing quality coatings and films.** Jahn, R.; Liepins, R.; Cisneros, S. May 1988. NTIS, PC A 17. Order Number DE88010660/JAW. (CONF-8710302—).

From JOWOG 28A; Los Alamos, NM, USA (6 Oct 1987).

An automated parylene coater has been developed. The coater design and performance are presented. Particular attention is paid to the various sources available.

11422 (LA—11304-C, pp 107-140) **Deposition rate dependence of plasma polymerization on the radius of curvature of the substrate.** Lintz, H.K.; Murrell, S.R.; Crawley, R.L.; Daukas, J.C. (KMS Fusion, Inc., Ann Arbor, MI (USA)). May 1988. NTIS, PC A 17. Order Number DE88010660/JAW. (CONF-8710302—).

From JOWOG 28A; Los Alamos, NM, USA (6 Oct 1987).

In the plasma polymerization deposition of CH/sub x/ onto microspherical Inertial Fusion targets the authors found that the coating rate varies with substrate diameter. Spherical shells ranging in diameter from 100 to 1000 microns were coated with several microns of plasma polymerized trans-2-butene under identical conditions and their coating thicknesses measured interferometrically. They found that the coating rate variation with shell radius could be described by an equation having the form $dr/dt = A/(R + r) + B$ where dr/dt is the coating rate, R the initial sphere radius, r the coating thickness, and A and B parameters related to the plasma conditions. They also found that there exists a functional relationship between the parameters A and B which is dependent on the RF power density.

11423 (LA—11304-C, pp 174-192) **Effect of water on the adhesion of organic coatings and its mitigation by surface treatments.** Walker, P. May 1988. NTIS, PC A 17. Order Number DE88010660/JAW. (CONF-8710302—).

From JOWOG 28A; Los Alamos, NM, USA (6 Oct 1987).

Water has a deleterious effect on the adhesion of organic coatings. Surface treatments are examined that ameliorate the effects of water.

11424 (LA—11304-C, pp 193-212) **Epoxy protective coatings for long-term exposure to acids and bases.** MacKay, H.A. May 1988. NTIS, PC A 17. Order Number DE88010660/JAW. (CONF-8710302—).

From JOWOG 28A; Los Alamos, NM, USA (6 Oct 1987).

Epoxy novolacs were selected as candidate coating materials for protection of pumps and other on-line equipment used in plutonium processing facilities where high concentrations of nitric acid and/or sodium hydroxide are encountered. The epoxy novolacs are thermoset resins that combine, in one molecule, the stability and chemical resistance of a phenolic backbone with the reactivity, versatility, and processing ease of an epoxy resin. The additional reactive sites of the epoxy novolac, as compared to a bisphenol-A type epoxy, produce tightly crosslinked systems with improved resistance to acids, bases, and solvents; improved retention of properties at elevated temperatures.

11425 (LA—11304-C, pp 213-241) **Electrically conducting conversion coatings.** Terry, C.A.; Walker, P. May 1988. NTIS, PC A 17. Order Number DE88010660/JAW. (CONF-8710302—).

From JOWOG 28A; Los Alamos, NM, USA (6 Oct 1987).

The program to deliver pre-evaluated, conducting, high-temperature, polymer-coated samples is discussed. The relationship between electrical conductivity of a coating and its corrosion protection efficiency is investigated.

11426 (LA—11304-C, pp 242) **Non-chromate pigments as a replacement for zinc chromate in corrosion resistant coatings. Part 1. Chlorinated rubber binders.** Walker, P. (Atomic Weapons Establishment, Aldermaston (England)). May 1988. NTIS, PC A 17. Order Number DE88010660/JAW. (CONF-8710302—).

From JOWOG 28A; Los Alamos, NM, USA (6 Oct 1987).

Recent legislation in Scandinavia on the use of soluble chromate pigments in anti-corrosive paints and the increasing pressure of environmental health organizations such as OSHA may result in a long term ban on the use of chromate pigments in the surface coatings industry. Such a ban would lead to a need for replacement materials having a corrosion resistance equal to that of existing paints containing zinc chromate. AWE has started a program to examine some of the alternative materials now either commercially available or in the development stage. The paper describes the results of an on-going program in which selected pigments have been incorporated into a chlorinated rubber binder and exposed to water immersion, cyclic humidity, salt spray and accelerated tests in a direct comparison with zinc chromate.

11427 (LA—11304-C, pp 243-263) **Coatings and other technologies for the removal of RA contamination.** Morgan, C. (Atomic Weapons Establishment, Aldermaston (England)). May 1988. NTIS, PC A 17. Order Number DE88010660/JAW. (CONF-8710302—).

From JOWOG 28A; Los Alamos, NM, USA (6 Oct 1987).

The use of carbon dioxide grit as a surface cleaning tool is examined. It is shown that paint can be removed very efficiently.

11428 (LA—11304-C, pp 264-277) **Characterization of VACREL 940 Solder Mask and comparison with UV epoxy coating, HA-84.** Pemberton, S.E. May 1988. NTIS, PC A 17. Order Number DE88010660/JAW. (CONF-8710302—).

From JOWOG 28A; Los Alamos, NM, USA (6 Oct 1987).

The characterization of VACREL 940 Solder Mask was undertaken to prove that it could maintain electron scavenging capabilities (a characteristic of conformal coatings). UV epoxy HA-84, a known conformal coating, developed by Sandia National Laboratories, Albuquerque (SNLA) was used for comparison.

11429 (LA—11304-C, pp 278-289) **Parylene as a protective coating for magnesium/zirconium alloy components.** Walker, P. May 1988. NTIS, PC A 17. Order Number DE88010660/JAW. (CONF-8710302—).

From JOWOG 28A; Los Alamos, NM, USA (6 Oct 1987).

A process has been developed to use parylene-n as a protective coating for magnesium and zirconium alloy components. Corrosion resistance was determined and found to be adequate with a coating thickness of 3 to 4 microns.

11430 (LA—11304-C, pp 290-313) **Coating with the low pressure plasma coater - uranium, lithium hydride, and surprises.** Weatherspoon, K. (Oak Ridge Y-12 Plant, TN (USA)). May 1988. NTIS, PC A 17. Order Number DE88010660/JAW. (CONF-8710302—).

From JOWOG 28A; Los Alamos, NM, USA (6 Oct 1987).

A plasma coating source was used to put protective films on lithium hydride and uranium. The p-xylene and l-butene monomers were found to be effective coatings for uranium. No adequate coating was found for the lithium hydride.

11431 (LA—11304-C, pp 313) **Robotic painting of multi-geometry shapes.** Terry, C.A.; Walker, P.; Parmee, A.C. (Atomic Weapons Establishment, Aldermaston (England)). May 1988. NTIS, PC A 17. Order Number DE88010660/JAW. (CONF-8710302—).

From JOWOG 28A; Los Alamos, NM, USA (6 Oct 1987).

The application of RAM Coatings to achieve surface conductivities within +/- 20% of the target figures to multi-geometry shapes is illustrated by means of a video presentation and accompanying commentary. The factors influencing the conductivity of the coatings and the programming of the Robot are described in detail and data on the uniformity of the coating presented.

11432 (LA—11304-C, pp 314-338) **Formulation, selection and application of coatings for radio-active facilities.** Walker, P. May 1988. NTIS, PC A 17. Order Number DE88010660/JAW. (CONF-8710302—).

From JOWOG 28A; Los Alamos, NM, USA (6 Oct 1987).

The use of appropriate coatings on materials involved in the handling radioactivity substantially reduces the effort required for decontamination. Development and performance are demonstrated for materials of choice. Future directions and requirements are indicated.

11433 (LA—11304-C, pp 339-370) **Electrophoretic coating in a mound component application.** Koeller, T.L.; Wang, P.S.; Trainer, P.D.; DiChiaro, J.V.; Sharp, D.J. May 1988. NTIS, PC A 17. Order Number DE88010660/JAW. (CONF-8710302—).

From JOWOG 28A; Los Alamos, NM, USA (6 Oct 1987).

A Mound/SNLA program is utilizing an electrophoretic deposition process to apply a thin conformal coating to an aluminum housing of one of it newer components. The clear acrylic resin, Whitaker's 670-C7 processes readily to yield a uniform 1 mil coating with excellent adhesion and dielectric properties. Surface analysis shows that the electrophoretic process generates an aluminum oxide layer 800 Angstrom thick beneath the depositing coating resulting in enhanced adhesion. Furthermore, a stripping process was developed to selectively remove the coating prior to cure along a narrow boundary earmarked for a subsequent laser weld. The coating was shown to bond well to both a urethane encapsulant and an epoxy adhesive.

11434 (LA—11304-C, pp 371) **Unique application for Sylgard/sup R/ 184.** Saiki, D.M.; Fenner, G.S.; Casados, E. May 1988. NTIS, PC A 17. Order Number DE88010660/JAW. (CONF-8710302—).

From JOWOG 28A; Los Alamos, NM, USA (6 Oct 1987).

A process was developed and evaluated for molding/bonding Sylgard 184 to a stainless steel surface. Procedures were developed for cleaning and priming the stainless steel surface. Vacuum potting and pressure injection processes were evaluated as alternative methods for injecting the liquid resin into a uniquely designed mold. Some problems associated with the modeling process will be discussed.

11435 (LA—11304-C, pp 372-382) **UV Cured epoxide coating.** Wischmann, K.B. (Sandia National Labs., Albuquerque, NM (USA)). May 1988. NTIS, PC A 17. Order Number DE88010660/JAW. (CONF-8710302—).

From JOWOG 28A; Los Alamos, NM, USA (6 Oct 1987).

A new UV cured epoxide protective coating is based on a cycloaliphatic epoxide that can be cured in seconds with photoinitiators to a clear, durable surface. Modifiers can be added to improve flexibility, toughness, and adhesion. This coating is 100% solids; thus, compared to other solvent based coatings, it has the following advantages: low outgassing, low cure shrinkage, good aging characteristics, rapid processing, low toxicity, abrasion resistance, and excellent electrical and mechanical properties. The coating will bond to virtually any clean substrate. It has been successfully used on several projects and should continue to find widespread application.

11436 (LA—11304-C, pp 383) **Multi-Layer moisture resistant coatings for lithium hydride/deuteride.** Reiner, R.H. (Oak Ridge Y-12 Plant, TN (USA)). May 1988. NTIS, PC A 17. Order Number DE88010660/JAW. (CONF-8710302—).

From JOWOG 28A; Los Alamos, NM, USA (6 Oct 1987).

Lithium hydride and lithium deuteride (LiH/D) samples have been conversion coated and overcoated with Parylene to retard hydrolysis during handling and storage. The moisture protection of this multiple layer coating is compared with uncoated LiH/D and LiH/D conversion coated or coated with Parylene at various humidity levels. The advantages of multiple layer coatings over individual Parylene or conversion coatings are presented. Potential applications of multiple layer coatings are also discussed.

11437 **(N—89-10130) Properties of silicon carbide fiber-reinforced silicon nitride matrix composites.** Bhatt, R.T. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). Jun 1988. 17p. (NASA-TM—101356; E—4386; NAS—1.15:101356; AVSCOM-TR—88-C-027; CONF-8806103—). NTIS, PC A03/MF A01.

From International conference on whisker- and fiber-toughened ceramics; Oak Ridge, TN, USA (7 Jun 1988).

The mechanical properties of NASA Lewis developed SiC/RBSN composites and their thermal and environmental stability have been studied. The composites consist of nearly 30 vol pct of aligned 142 micron diameter chemically vapor-deposited SiC fibers in a relatively porous silicon nitride matrix. In the as-fabricated condition, the unidirectional and 2-D composites exhibited metal-like stress-strain behavior, graceful failure, and showed improved properties when compared with unreinforced matrix of comparable density. Furthermore, the measured room temperature tensile properties were relativley independent of tested volume and were unaffected by artifical notches normal to the loading direction or by thermal shocking from temperatures up to 800 C. The four-point bend strength data measured as a function of temperature to 1400 C in air showed that as-fabricated strength was maintained to 1200 C. At 1400 C, however, nearly 15 pct loss in strength was observed. Measurement of room temperature tensile strength after 100 hr exposure at temperatures to 1400 C in a nitrogen environment indicated no loss from the as-fabricated composite strength. On the other hand, after 100 hr exposure in flowing oxygen at 1200 and 1400 C, the composites showed approximately 40 pct loss from their as-fabricated ultimate tensile strength. Those exposed between 400 to 1200 C showed nearly 60 pct strength loss. Oxidation of the fiber/

matrix interface as well as internal oxidation of the porous Si3N4 matrix are likely mechanisms for strength degradation. The excellent strength reproducibility, notch insensitivity, and high temperature strength of the composite makes it an ideal candidate for advanced heat engine applications provided coating or densification methods are developed to avoid internal oxidation attack.

11438 **(N—89-10166) Sintering model for SiC(sub)w/ Si_3N_4 composites.** Freedman, M.R.; Kiser, J.D.; Sanders, W.A. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). 1988. 19p. (NASA-TM—101336; E—4354; NAS—1.15:101336; CONF-880504—). NTIS, PC A03/MF A01.

From 90. annual meeting of American Ceramic Society; Cincinnati, OH, USA (1 May 1988).

Presented is a model which suggests that it should be possible to pressureless sinter a SiC(sub w)/ Si_3N_4 composite to theoretical density. Prior failure to achieve complete densification by sintering is attributed to the use of compositions which result in a glass deficit. There is one basic premise for this model. The ratio of glass amount to surface area of nonglass constituents must be the same for both composite and sinterable monolithic Si_3N_4. This model suggests that whisker and grain sizes and whisker loading influence the glass amount necessary for successful sintering of composites. According to the model, a large glass amount will be necessary for successful sintering of these composites. However, grain boundary thicknesses in the composite will be less than those in the analogous monolithic materials. This suggests that good high temperature strength may still be attained. A recent report supports the predictions of the model.

11439 **(NSTC—1979) A continuing study of electrically conducting ceramics. Final report, August 9, 1978 - March 31, 1979.** (Nova Scotia Technical Coll., Halifax (Canada). Dept. of Chemical Engineering). 1979. 57p. (CE—02213). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

A series of 36 perovskite ceramics based on SrZrO/sub 3/ has been prepared and investigated as potential materials for electrodes for MHD systems using hydrogen as a fuel. All ceramics prepared were found to be relatively dark in color, indicating optical absorptions associated with the existence of conduction electrons. Many were found to be soft and crumbly after firing at 1400/sup 0/ or 1500/sup 0/C, but became hard and often quite shiny when fired at 1650/sup 0/C using a special graphite induction furnace. In most cases, this increase in hardness was also accompanied by a significant density increase. Most ceramics were found to be composed of second perovskite structures, i.e. manganates of Ba, Ca, Sr or La, in addition to the zirconate phase. Their room temperature electrical resistivity was determined by the van der Paaw method. Results show that resistivity falls below 100 ohm-cm (the value acceptable for MHD electrodes) for certain ceramics of the types tested. The resistivity value was found to vary significantly with firing temperature; this can be correlated with the crystal structures and number of phases within the ceramic. Weight loss measurements done at 1440/sup 0/C have enabled three ceramics to be identified as potential materials for thermoelectric converters requiring high temperature structural and chemical stability in oxidizing atmospheres. An appendix reviews the current status of the basis for development of perovskite ceramics and specific materials are discussed on the basis of relevant thermoelecttic properties. Also included is a review of semiconductor thermocouples and of materials selection for insulators and electrodes for use in MHD systems. 91 refs., 3 figs., 10 tabs.

11440 **(ORNL/TM—10884) Chemical vapor deposition in the silicon-carbon and boron-carbon-nitrogen systems.** Besmann, T.M. (Oak Ridge National Lab., TN (USA)). Nov 1988. Contract AC05-84OR21400. 26p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005675/JAW.

The chemical vapor deposition of SiC from methyltrichlorosilane was studied using a combination of measurement and analytical techniques. Equilibrium analysis and mass spectrometric measurements were used to identify gas-phase species and determine their concentrations. Analysis of kinetic data coupled with a thermokinetic assessment allowed determination of rate-limiting mechanisms. The preparation of a two-phase coating of B_4C-BN was addressed as a potential wear coating, because of its likelihood of having a high fracture toughness resulting from its composite nature and inherent lubrication resulting from the presence of BN. Equilibrium analysis identified appropriate deposition conditions; however, deposited coatings were found to be single-phase BN with a high degree of substitution of carbon for nitrogen. 9 refs., 10 figs., 3 tabs.

11441 **(ORNL/TM—10896) Corrosion of materials in chemical heat pump working fluids.** DeVan, J.H.; Wolf, J.S. (Oak Ridge National Lab., TN (USA)). Nov 1988. Contract AC05-84OR21400. 41p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005687/JAW.

A series of laboratory tests were conducted to evaluate the performance of type A106B and 2.25Cr-1Mo steels, types 304 and 304L stainless steel, and the nickel-base alloy Monel 400 in chemical heat pump environments based on aqueous nitrate salt mixtures. Autoclave screening tests were initially performed to evaluate the stress corrosion cracking (SCC) properties of the materials at temperatures of 170, 210, and 250{degree}C, respectively. In 2-week tests, one of two heats of A106B exhibited cracking tendencies, but all of the other materials showed no evidence of SCC or significant general corrosion. The cracking tendency of the susceptible steel was associated with an abnormal carbide morphology. A series of 250{degree}C capsule tests, conducted for times of up to 6 months, similarly indicated that neither SCC nor general corrosion was a problem area for these material-environment combinations. General corrosion rates were <0.1 mil/year (mpy). The two materials that performed best, type A106B mild steel and type 304L stainless steel, were tested while being dynamically strained in an 80% nitrate salt/20% water mixture at 250{degree}C. These materials survived the tests with no indication of SCC or other significant corrosion effects. Based on this relatively short-term laboratory test program, type 304L stainless steel and A106B carbon steel can be recommended as candidate classes of structural materials for the nitrate-carrying piping of the chemical heat pump. It is noted that stringent microstructural control may be required in the case of type A106B piping. 2 refs., 14 figs., 7 tabs.

11442 **(SAND—88-1696C) Selective photochemical dry etching of compound semiconductors: Enhanced control through secondary electronic properties.** Ashby, C.I.H. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 10p. (CONF-881155—30). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005056/JAW.

From Fall meeting of the Materials Research Society; Boston, MA, USA (28 Nov 1988).

When laser-driven etching of a semiconductor requires direct participation of photogenerated carriers, the etching quantum yield will be sensitive to the electronic properties of a specific semiconductor material. The band-gap energy of the semiconductor determines the minimum photon energy needed for carrier-driven etching since sub-gap photons do not generate free carriers. However, only those free carriers that reach the reacting surface contribute to etching and the ultimate carrier flux to the surface is controlled by more subtle electronic properties than the lowest-energy band gap. For example, the initial depth of carrier generation and the probability of carrier recombination between the point of generation and the surface profoundly influence the etching quantum yield. Appropriate manipulation of process parameters can provide additional reaction control based on such secondary electronic properties. Applications to selective dry etching of GaAs and related materials are discussed here. 17 refs., 7 figs.

11443 **(UCID—21553) Analysis of inclusion stress response in materials surrounding a torpedo shaped gage package.** Stout, R.B.; Larson, D.B.; Thigpen, L. (Lawrence Livermore National Lab., CA (USA)). Nov 1988. Contract W-7405-ENG-48. 26p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89002822/JAW.

A displacement-stress analysis of a torpedo-shaped gage package is developed. This analysis is necessary in order to infer

compressive stress-strain history data from the response of the gage when it is embedded in a material that surrounds an underground nuclear explosion. A torpedo-shaped gage package consists of a copper shell surrounding a cylinder of PMMA with embedded piezoresistive foils. Recent experimental and analytical results are reviewed which showed that the resistance response from foils embedded in PMMA can be inverted to obtain a set of stress-strain histories in the PMMA. In axial-symmetrical loaded geometries, this set of stress-strain histories is sufficient to completely describe the elastic displacement and stress response of the PMMA cylinder. By matching displacement and traction boundary conditions at the PMMA-copper interface the elastic response of the copper can also be described. The next analysis step is to relate the displacement-stress response at the exterior surface of the copper shell to the stress response in the surrounding material. Two different cases are considered: one case is called quasi-plane strain to approximate an axially weak gage package relative to the strength of the surrounding material, and the second case is called quasi-plane stress to approximate an axially strong gage package relative to the strength of the surrounding material. Results show that compressive stress histories inferred in the surrounding material are greater than compressive stress histories measured in the PMMA for a "weak" gage package placed in a "strong" surrounding material. And for the other situation of a "strong" gage package placed in a "weak" surrounding material are less than the compressive stress histories measured in the PMMA. 12 refs., 5 figs.

11444 **Figure of merit for thermoelectrics.** Mahan, G.D. (Department of Physics and Astronomy, University of Tennessee, Knoxville, Tennessee 37996-1200 and Solid State Division, Oak Ridge National Laboratory, P.O. Box 2008, Oak Ridge, Tennessee 37831-6030). *Journal of Applied Physics;* **65**: No. 4, 1578-1583(15 Feb 1989).

Theoretical calculations are presented for the figure of merit Z in thermoelectrics. The maximum values of Z are obtained in semiconductors which are doped so that the chemical potential is near the band edge. The highest Z is related to the B parameter of Chasmar and Stratton [J. Electron. Control 7, 52 (1959)].

11445 **Oxidation studies of SiGe.** LeGoues, F.K.; Rosenberg, R.; Nguyen, T.; Himpsel, F.; Meyerson, B.S. (IBM T. J. Watson Research Center, Yorktown Heights, New York 10598). *Journal of Applied Physics;* **65**: No. 4, 1724-1728(15 Feb 1989).

We have studied the kinetics and mechanism of oxidation of SiGe alloys deposited epitaxially onto Si substrates by low-temperature chemical vapor deposition. Ge is shown to enhance oxidation rates by a factor of about 3 in the linear regime, and to be completely rejected from the oxide so that it piles up at the SiO_2/SiGe interface. We demonstrate that Ge plays a purely catalytic role, i.e., it enhances the reaction rate while remaining unchanged itself. Electrical properties of the oxides formed under these conditions are presented, as well as microstructures of the oxide/substrate, Ge-enriched/SiGe substrate, and SiGe/Si substrate interfaces, and x-ray photoemission studies of the early stages of oxidation. Possible mechanisms are discussed and compared with oxidation of pure silicon.

11446 **Surface enrichment in an isotopic polymer blend.** Jones, R.A.L.; Kramer, E.J.; Rafailovich, M.H.; Sokolov, J.; Schwarz, S.A. (Department of Materials Science and Engineering, and the Materials Science Center, Cornell University, Ithaca, New York 14853). *Physical Review Letters;* **62**: No. 3, 280-283(16 Jan 1989).

Forward recoil spectrometry reveals that the surface of a blend of deuterated polystyrene (d-PS) and protonated polystyrene (PS) is enriched with d-PS relative to the bulk; the surface excess of d-PS increases almost linearly with the bulk volume fraction phi of d-PS at 184 °C. The results may be interpreted quantitatively with mean-field theory, and yield a form of the bare surface energy of the blend consistent with the surface enrichment being driven by a surface energy difference between d-PS and hydrogenated polystyrene (h-PS) of isotopic origin.

11447 **Phason velocities in TaS_2 by x-ray diffuse scattering.** Minor, W.; Chapman, L.D.; Ehrlich, S.N.; Colella, R. (Department of Physics, Purdue University, West Lafayette, Indiana 47907). *Physical Review* [*Section*] *B: Condensed Matter;* **39**: No. 2, 1360-1362(15 Jan 1989).

The diffuse x-ray scattering surrounding satellite reflections caused by charge-density waves has been measured at two different temperatures and analyzed in terms of phason scattering. From this analysis, the phason velocity has been obtained for all directions of propagation.

11448 **Determination of AB crystal structures from atomic properties.** Zhang, S.B.; Cohen, M.L. (Department of Physics, University of California, Berkeley, California 94720). *Physical Review* [*Section*] *B: Condensed Matter;* **39**: No. 2, 1077-1080(15 Jan 1989).

We use atomic pseudopotential s-orbital radii and Pauling electronegativity chi to distinguish between four types of crystal structures (ZnS, NaCl, CsCl, and MnP or NiAs) for AB compounds. By relating chi to the s-orbital radii, an even simpler scheme results, indicating the important role of pseudopotential s-orbital radii for structural determination.

11449 **Structural phase transitions in GaAs to 108 GPa.** Weir, S.T.; Vohra, Y.K.; Vanderborgh, C.A.; Ruoff, A.L. (Department of Materials Science and Engineering, Cornell University, Ithaca, New York 14853). *Physical Review* [*Section*] *B: Condensed Matter;* **39**: No. 2, 1280-1285(15 Jan 1989).

The III-V compound GaAs was studied using energy-dispersive x-ray diffraction with a synchro- tron source up to a pressure of 108 GPa. When the pressure was increased to 16.6 GPa, the GaAs sample transformed from the zinc-blende structure to an orthorhombic structure [GaAs(II)], space group Pmm2, consisting of a primitive orthorhombic lattice with a basis of (0,0,0) and (0,(1/2,α), where α = 0.35. Upon a further increase of pressure to 24 +- 1 GPa, GaAs(II) transformed to another orthorhombic structure [GaAs(III)], space group Imm2, consisting of a body-centered orthorhombic lattice with a basis of (0,0,0) and (0, (1/2,Δ), where Δ is 0.425 at 28.1 GPa. With increasing pressure, Δ approached (1/2 and the GaAs(III) structure gradually assumed the symmetry of the simple hexagonal structure. The transition to the simple hexagonal structure [GaAs(IV)] was completed in the vicinity of 60—80 GPa. The structure remains simple hexagonal up to at least 108 GPa, the highest pressure reached in this study.

11450 **Theory of the structure of high-pressure GaAs II.** Zhang, S.B.; Cohen, M.L. (Department of Physics, University of California, and Materials and Chemical Sciences Division, Lawrence Berkeley Laboratory, Berkeley, California 94720). *Physical Review* [*Section*] *B: Condensed Matter;* **39**: No. 2, 1450-1452(15 Jan 1989).

We examine proposals for the high-pressure phase of GaAs II using a first-principles pseudopotential approach. An orthorhombic structure is found to have lower energy than those of previously studied β-Sn and NaCl structures at a volume near which the phase transition occurs. The structure and the calculated lattice parameters are in excellent agreement with recent x-ray experiments.

11451 **Applicability of the deformation-potential approximation to deep donors in silicon.** Bergman, K.; Grossmann, G.; Grimmeiss, H.G.; Stavola, M.; McMurray R.E. Jr. (Department of Solid State Physics, University of Lund, Box 118, S-221chemical bond00 Lund, Sweden). *Physical Review* [*Section*] *B: Condensed Matter;* **39**: No. 2, 1104-1119(15 Jan 1989).

Several deep double donors due to sulfur and selenium impurities, both isolated and in pairs, have been investigated in infrared-absorption and uniaxial-stress experiments. The study of several similar centers in their different charge states allows trends in parameters to be revealed. Particular attention is given to the applicability of effective-mass theory (EMT) and the deformation-potential approximation (DPA) to the various states studied. The np excited states are well described by EMT and hence their behavior under stress by the DPA. The deep 1s ground states do not follow DPA

but shift linearly with respect to the center of gravity of the conduction bands with shift rates that increase with the ionization energy of the centers. Excited 1s states which are deeper than predicted by EMT are also observed to deviate from DPA. A perturbation approach beyond the DPA is developed to fit and compare data. For nontetrahedral centers the stress lifts their orientational degeneracy. The $1s(A_1^+) \rightarrow ns$ transitions of chalcogen pairs are well described by DPA if matrix elements that couple the ns states are accounted for. For some centers, stress-induced crossings between allowed and forbidden states reveal information on states [1s(E) and spin-triplet states] that are not accessible by dipole transitions.

11452 **Energy levels and charge distributions of nonideal dangling and floating bonds in amorphous Si.** Fedders, P.A.; Carlsson, A.E. (Department of Physics, Washington University in Saint Louis, Campus Box 1105, St. Louis, Missouri 63130). *Physical Review [Section] B: Condensed Matter;* **39**: No. 2, 1134-1139(15 Jan 1989).

Defect-state wave functions and energies are calculated for numerous configurations of nonideal dangling and floating bonds in a-Si with use of Bethe-lattice-terminated clusters and a tight-binding approach. The energy eigenvalue for the dangling bond is highly dependent on deviations from ideality while the wave-function amplitudes are much less so. Exactly the opposite holds for the floating bond. The experimental consequences of these calculations are discussed.

11453 **Role of hydrogen in the formation of metastable defects in hydrogenated amorphous silicon.** Jackson, W.B.; Marshall, J.M.; Moyer, M.D. (Xerox Corporation, Palo Alto Research Center, Palo Alto, California 94304). *Physical Review [Section] B: Condensed Matter;* **39**: No. 2, 1164-1179(15 Jan 1989).

This paper presents results of studies on carrier-induced metastable defect creation in hydrogenated amorphous silicon. The metastable defects were studied by measuring the threshold voltage shifts on thin-film amorphous silicon transistors and capacitors as a function of time, temperature, and bias. The kinetics (time, temperature, bias, and doping dependence) of these defects as well as most other metastable-defect processes are quantitatively explained by hydrogen diffusion and the creation of defects due to the presence of excess band-tail carriers.

11454 **Deuterium diffusion and magnetic resonance investigations in $LiTaO_3$ single crystals.** Gonzalez, R.; Hantehzadeh, R.; Chen, C.Y.; Halliburton, L.E.; Chen, Y. (Solid State Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee 37831-6032). *Physical Review [Section] B: Condensed Matter;* **39**: No. 2, 1302-1306(15 Jan 1989).

The diffusion coefficients of deuterium in single crystals of $LiTaO_3$ have been measured by monitoring the growth of OD^- infrared-absorption bands in samples heated in flowing D_2O vapor. At 950 K, the diffusion coefficient is 1.7 x 10/sup -8/ cm^2/s for diffusion along the crystallographic c axis, and the activation energy is 1.5 eV. Electric-field-enhanced diffusion of deuterium was also demonstrated. Proton replacement and electron-nuclear double resonance experiments have shown that the structure previously reported in the electron paramagnetic resonance spectrum of a radiation-induced center in $LiTaO_3$ is not due to a hyperfine interaction with protons.

11455 **Electronic- and vibrational-structure calculations in models of the compressed SiO_2 glass system.** Murray, R.A.; Ching, W.Y. (Department of Physics and Astronomy, University of Kansas, Lawrence, Kansas 66045). *Physical Review [Section] B: Condensed Matter;* **39**: No. 2, 1320-1331(15 Jan 1989).

The electronic and vibrational structures of normal and compressed SiO_2 glasses are studied using realistic continuous-random-network models with periodic boundaries. The electronic structure is calculated by the first-principles orthogonalized linear combination of atomic orbitals (OLCAO) method and the results are presented for density of states, band gaps, effective charges, and localization of wave functions as a function of density. The vibrational density of states, infrared absorption, and Raman spectra for these models are also calculated with use of a Keating-type potential and the bond-polarizability approximation. The results are, generally, in good agreement with experiments on both normal and "densified" a-SiO_2. In particular, the two Raman lines at 495 and 606 cm/sup -1/ are reproduced by our calculation in direct contrast to the paracrystalline theory of SiO_2 glass. Inspection of eigenvectors in conjunction with a detailed analysis of the bonding patterns of participating atoms indicate that specific Si-O-Si angles (close to those found in threefold or fourfold rings) are responsible for these modes.

11456 **Solid krypton: Equation of state and elastic properties.** Polian, A.; Besson, J.M.; Grimsditch, M.; Grosshans, W.A. (Physique des Milieux Condenses, Universite Pierre et Marie Curie, Tour 13, Etage 4, 4 place Jussieu, F-75252 Paris CEDEX 05, France). *Physical Review [Section] B: Condensed Matter;* **39**: No. 2, 1332-1336(15 Jan 1989).

The properties of solid krypton have been measured as a function of pressure in a diamond-anvil cell using energy-dispersive x-ray diffraction and Brillouin scattering. A room-temperature equation of state and a complete set of elastic constants are deduced. The analysis of these results indicates a possible phase transition above 30 GPa.

11457 **Elastic properties of Si/sub x/Se/sub 1-//sub x/ glasses.** Bhadra, R.; Susman, S.; Volin, K.J.; Grimsditch, M. (Materials Science Division, Argonne National Laboratory, Argonne, Illinois 60439). *Physical Review [Section] B: Condensed Matter;* **39**: No. 2, 1378-1380(15 Jan 1989).

Transverse and longitudinal phonons have been studied in Si/sub x/Se/sub 1-//sub x/ glasses over a wide composition range. The results show anomalous behavior at $x = 0.33$ consistent with a structural transformation. Above $x = 0.33$ our results are consistent with the theory of "rigidity percolation."

11458 **Normally unoccupied states on C(111) (diamond) (2 x 1): Support for a relaxed π-bonded chain model.** Kubiak, G.D.; Kolasinski, K.W. (Sandia National Laboratories, P.O. Box 969, Livermore, California 94551-0969). *Physical Review [Section] B: Condensed Matter;* **39**: No. 2, 1381-1384(15 Jan 1989).

A normally unoccupied electronic state on the reconstructed (2 x 1) surface of C(111) (diamond) is characterized with angle-resolved two-photon photoelectron spectroscopy. The state is seen in the bulk band gap, lying 4.8 eV above the valence-band maximum. Comparison between the measured dispersion of this band and published theoretical band-structure calculations supports a relaxed Pandey π-bonded chain model of the surface reconstruction.

11459 **Evidence for spin splitting in In/sub x/Ga/sub 1-//sub x/As/In/sub 0.52/Al/sub 0.48/As heterostructures as $B \rightarrow 0$.** Das, B.; Miller, D.C.; Datta, S.; Reifenberger, R.; Hong, W.P.; Bhattacharya, P.K.; Singh, J.; Jaffe, M. (School of Electrical Engineering, Department of Physics, Purdue University, West Lafayette, Indiana 47907). *Physical Review [Section] B: Condensed Matter;* **39**: No. 2, 1411-1414(15 Jan 1989).

The splitting in zero magnetic field between the up- and down-spin electrons in a two-dimensional electron gas is obtained for a series of three different In/sub x/Ga/sub 1-//sub x/As/In/sub 0.52/Al/sub 0.48/As modulation-doped heterostructures with high electron densities [n/sub s/ ~ (1.5—1.8) x 10/sup 12/ cm/sup -2/]. We have observed a characteristic beating modulation in the amplitude of the Shubnikov—de Haas oscillations in this system and up to six nodes have been measured in the Shubnikov—de Haas data for magnetic fields in the range $0.15T < B < 1.0$ T. Analysis of these data indicates that one subband is primarily occupied and the two beating frequencies arise from a spin splitting of the lowest subband. A spin splitting of 1.5—2.5 meV as $B \rightarrow 0$ is deduced from the data. For magnetic fields applied at an angle θ to the interface, the beat positions scale as $\cos\theta$ for small angles but increase steeply after a critical angle.

11460 InSb(100) reconstructions probed with core-level photoemission. John, P.; Miller, T.; Chiang, T. (Department of Physics and Materials Research Laboratory, University of Illinois at Urbana-Champaign, 1110 West Green Street, Urbana, Illinois 61801). *Physical Review [Section] B: Condensed Matter;* **39**: No. 3, 1730-1737(15 Jan 1989).

The InSb(100) surface was grown using the techniques of molecular-beam expitaxy. The surface was found to undergo several surface reconstructions, including a c(4 x 4), a c(8 x 2), an asymmetric (1 x 3), a symmetric (1 x 3), and a (1 x 1). High-resolution photoemission spectra of the In and Sb 4d core levels clearly exhibited surface-shifted components for some of these reconstructed surfaces. Analyses of the In and Sb core-level photoemission intensities as well as of the surface to bulk intensity ratios for the c(4 x 4) and c(8 x 2) structures were carried out. The c(4 x 4) surface was found to be terminated with 1—(3/4 monolayers of Sb, while (3/4 monolayer of In was found to be the termination of the c(8 x 2) surface. Structural models are proposed for the c(8 x 2) and c(4 x 4) based upon these coverages and upon existing models of the similar GaAs(100) structures.

11461 Hole trapping, light soaking, and secondary photocurrent transients in amorphous silicon. McMahon, T.J.; Crandall, R.S. (Solar Energy Research Institute, 1617 Cole Boulevard, Golden, Colorado 80401). *Physical Review [Section] B: Condensed Matter;* **39**: No. 3, 1766-1771(15 Jan 1989).

We measured and analyzed the long-time photocurrent decays in films of undoped amorphous silicon with coplanar Ohmic contacts. We interpret these as a secondary-electron current which flows as long as holes are safely trapped in states 0.3 to 0.5 eV above the valence-band edge. A new analysis of these transients gives the distribution of the trapped holes and implicates thermally assisted tunneling to dangling bonds as the rate-limiting step in hole recombination. Photoconductive gain is lost and the decay time shortened after small amounts of light soaking. The energetically deeper hole traps with the longer residence times are lost first and in the same number as expected for the increase in dangling bonds with a similar light soaking; this result supports a model which has hole trapping in valence-band-tail states as a precursor to light-induced dangling-bond formation. Two possible origins of these traps are discussed.

11462 Phonon-wind-driven transport of photoexcited carriers in a semiconductor quantum well. Smith, L.M.; Preston, J.S.; Wolfe, J.P.; Wake, D.R.; Klem, J.; Henderson, T.; Morkoc, H. (Department of Physics and Materials Research Laboratory, University of Illinois at Urbana-Champaign, Urbana, Illinois 61801). *Physical Review [Section] B: Condensed Matter;* **39**: No. 3, 1862-1870(15 Jan 1989).

The in-plane transport of photoexcited carriers in GaAsAl/ sub 0.3/Ga/sub 0.7/As multiple quantum wells is measured optically with 10 ps and 4 μm resolution. The local carrier density is measured by the bleaching of the excitonic absorption line. The expansion of the photoexcited carriers following a 6-ps pump pulse is found to be a strong function of excitation power and ambient temperature. At low powers, with initial carrier densities $n_0 \leqq 2 \times 10$/ sup 11/ cm/sup -2/, the spatial distribution is well described by a single expanding Gaussian profile corresponding to an effective diffusion constant D/sub e//sub f//sub f/(n_0,T). The power and temperature dependence suggests a phonon-wind driving mechanism. At higher densities ($n_0 > 2 \times 10$/sup 11/ cm/sup -2/) a narrow spatial profile appears which we attribute to "thermal confinement" of carriers within a phonon hot spot. After some delay, the "confined"-carrier distribution is observed to undergo a rapid expansion. This unusual effect is attributed to the "explosion" of the phonon hot spot, as predicted by Kazakovtsev and Levinson.

11463 Evidence of localized wave transmission. Ziolkowski, R.W.; Lewis, D.K.; Cook, B.D. (University of California, Lawrence Livermore National Laboratory, Livermore, California 94550). *Physical Review Letters;* **62**: No. 2, 147-150(9 Jan 1989).

The feasibility of launching an acoustic directed energy pulse train was tested experimentally. Excellent agreement between theoretical and experimental results was obtained.

11464 Dynamics of electron localization, solvation, and migration in polar molecular clusters. Barnett, R.N.; Landman, U.; Nitzan, A. (School of Physics, Georgia Institute of Technology, Atlanta, Georgia 30332 School of Chemistry, Tel Aviv University, 69978, Tel Aviv, Israel). *Physical Review Letters;* **62**: No. 1, 106-109(2 Jan 1989).

The time evolution of electron localization, migration, and solvation in ammonia clusters is investigated via computer simulations. The attachment of an electron to a cold molecular cluster in a diffuse weakly bound surface state, the dynamics of solvation, the nonhopping mechanism of migration leading to the formation of an internally solvated state, and the spectral manifestation of these processes are demonstrated.

40 CHEMISTRY

REFER ALSO TO CITATION(S) 11535

4001 Analytical And Separations Chemistry

REFER ALSO TO CITATION(S) 10711, 10741, 10742, 10743, 11052, 11379, 11670, 11750, 11771

11465 (AEEW-M—2514) Model surfactant studies VIII: development of an automated potentiometric method using a lead selective electrode for the determination of sodium sulphate. Lee-Tuffnell, C.D.; Read, A. (UKAEA Atomic Energy Establishment, Winfrith. Chemistry Div.). Jul 1988. 19p. British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ.

The development of an automated potentiometric technique using a lead selective electrode for the quantitative determination of aqueous sodium sulphate is discussed. It is important to be able to determine sulphate particularly in the presence of constituents associated with the model system, especially surfactant, which was found to obstruct the determination when employing a Dionex ion chromatograph. The new potentiometric method has reduced the time taken for the analytical determination of sulphate content whilst attaining excellent repeatability between different operators with high precision and accuracy. The analytical technique was unaffected by the presence of model system constituents, consequently the quantitative determination of sodium sulphate can now be performed on all model system phases.

11466 (CEA-CONF—9566) Modelling extraction and separation of some alpha-transition elements from acidic media by synergic combinations of aromatic polyimines and miceilar cationic exchangers. Vitart, X.; Musikas, C. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Genie Radioactif). 1988. 5p. (CONF-8807136—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88756223/JAW.

From ISEC '88: international solvent extraction conference; Moscow, USSR (18 Jul 1988).

In this paper is emphasized, taking the extraction and separation by Dinonylnaphtalene sulfonic acid (HDMNS)of rutheniumrhodium from a nitric acid media and nickel-cobalt from a sulfuric acid media as examples, the quantified chemical equilibria involved in order to elucidate the extraction mechanism. Reactions in aqueous media were investigated within three aspects: kinetics of formation, stability of metal complexes, ionic associations between complexes and mineral anions present in acidic media. This last point explains partly the selectivity of the system. The behaviour of HDNNS within extraction conditions, was studied leading to the structure of the micelle and to the quantification of equilibria involved (critical micelle concentration, polymerisation constant, etc...). Ligand extraction was studied previously to metal complexes extraction since the general mechanism of the system proceeds as a competitive extraction of cationic species in aqueous media (protonated forms of the free ligand, cationic metal complexes). The modelling of independent extraction of metals was used to predict numerically the behaviour of a multicomponent system where few metals are initially in aqueous media. These simulations are in accordance with experimental results.

11467 **(CNIC—00072) Fast neutron activation analysis (FNAA).** Zhang Shishen. (Academia Sinica, Beijing, BJ (China). Inst. of Atomic Energy). (China Nuclear Information Centre, Beijing, BJ). Aug 1987. 23p. (In Chinese). (IAE—0019). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704091/JAW.

This paper mainly describes basic principle for FNAA, experimental equipment, analytical techniques, advantages and disadvantages of the method, and some applications of FNAA to material science. Besides, some new developments and future trends in FNAA are briefly reviewed.

11468 **(CONF-880912—23) Solid state ^{13}C relaxation studies of coals.** Botto, R.E.; Axelson, D.E. (Argonne National Lab., IL (USA)). 1988. Contract W-31109-ENG-38. 8p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004513/JAW.

From 196. American Chemical Society national meeting; Los Angeles, CA, USA (25 Sep 1988).

Despite many studies of coal and related fossil fuels, no attempts have been made to systematically correlate changes in the solid state ^{13}C-NMR parameters as a function of static field strength. In particular, questions arise regarding differences in spectral resolution and relaxation parameters. While discrimination among the complex structural components of fossil fuels can be based on relaxation time differences, this also necessitates a more intensive study of static field-strength effects if a more complete understanding of coal structure is to be gained. Carbon-13 spin-lattice relaxation was chosen as the parameter of interest for this study because it represents a "dilute" nuclear spin system, which therefore minimizes spin diffusion interaction among phases. Furthermore, it is not as complicated to interpret as T /sub 1{rho}/ measurements, and exhibits a field dependence in the slow motion regime. These studies also comprise part of a more comprehensive on-going evaluation of the Argonne Premium Coal Samples. 12 refs., 5 figs., 3 tabs.

11469 **(FMPC—2072) An ion chromatography method for the determination of eight anions in biodenitrification liquor.** Spencer, E.B.; Gill, V.R.; Lehrter, R.W. (Westinghouse Materials Co. of Ohio, Cincinnati (USA). Feed Materials Production Center). Jul 1988. Contract AC05-86OR21600. 47p. NTIS, PC A03 - OSTI. Order Number DE89002402/JAW.

An Ion Chromatographic procedure was developed for the determination of eight anions in FMPC process wastewater being treated to remove nitrate in a biodenitrification reactor. The anions of interest were: F/sup {minus}/, CO_3/sup =/, Cl/sup {minus}/, NO_2/sup {minus}/, Br/sup {minus}/, NO_3/sup {minus}/, PO_4/sup {minus}3/ and SO_4/sup =/. The procedure employed an electronically suppressed Waters Company, Inc. (Waters) ILC-1 instrument equipped with an IC-PAK anion analytical column to perform the separation. A Waters 840 data station controlled the instrument, evaluated the data, and printed out the results. The procedure was applied to the analysis of samples from laboratory scale development reactors and a plant scale demonstration process employing two, twenty feet bioreactor towers. The analyses obtained were satisfactory for process control and process evaluation purposes. 6 refs., 36 figs., 5 tabs.

11470 **(GSI—88-22) From SRAFAP to SISAK - rapid chemical separations in nuclear research.** Herrmann, G. (Mainz Univ. (Germany, F.R.). Inst. fuer Kernchemie; Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.)). (Mainz Univ. (Germany, F.R.). Inst. fuer Kernchemie; Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.)). Oct 1988. 76p. (CONF-880604—). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88756354/JAW.

From Joint meeting of the 195th national meeting of the American Chemical Society and the 3rd Chemical Congress of North America; Toronto, Canada (5 Jun 1988).

The author gives an overview of rapid radiochemical separations, starting from the early experiments done by Rutherford up to the very sophisticated recoil fragment separations by fast on-line methods as an attempt to produce superheavy elements. Main emphasis is given to developments during the last decades and the extensive work performed by collaborators of the Nuclear Chemistry Institute at the University of Mainz.

11471 **(IEN-DICOB—3/84) Photochemical process of laboratory uranium wastes recovery.** Borges, O.N.; Barros, M.P. de. (Instituto de Engenharia Nuclear, Rio de Janeiro, RJ (Brazil)). 2 May 1984. 12p. (In Portuguese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704118/JAW.

A method for uranium extraction in presence of various aquometallic ions, based on selective photo-reduction of uranium is studied. Some economical advantages in relation with others conventional processes are analysed. (M.J.C.).

11472 **(INIS-BR—1235) Determination of helium in beryl minerals.** Souza Barcellos, E. de. (Minas Gerais Univ., Belo Horizonte (Brazil). Escola de Engenharia). Aug 1985. 107p. (In Portuguese). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88704122/JAW.

In order to obtain the diffusion coefficients of helium in beryl and phenacite samples at various temperatures, helium leak rates were measured in these minerals at these temperatures. Mass spectrometry (MS) was used to obtain helium leak rates and the gas flow was plotted against time. The gas quantity determined by MS was first obtained at various temperatures until no helium leak rate was detected. After that, these samples were irradiated with fast neutrons to produce helium which was measured again. This procedure was used to estimate the experimental error. The quantity of helium produced by interaction of gamma radiation with beryl minerals was theoretically calculated from the amount of thorium-232 at the neighbourhood of the samples. The quantity of helium produced in the minerals due to uranium and thorium decay was calculated using the amount of these heavy elements, and the results were compared with the amounts determined by MS. The amount of potassium-40 was determined in order to derive the quantity of argonium-40, since some workers found argonium in excess in these minerals. The quantity of helium in the beryl samples (s) was determined in the center and in the surface of the samples in order to obtain informations about the effectiveness of the Be(α, eta) He reaction. Beryl and phenacite minerals were choosen in this research since they are opposite each other with respect to the helium contents. Both have beryllium in their compositon but beryl hold a large amount of helium while phenacite, in spite of having about three times more beryllium than beryl, do not hold the gas.

11473 **(INIS-BR—1344) Carbon and Oxygen isotopic composition in paleoenvironmental determination.** Silva, J.R.M. da. (Sao Paulo Univ., SP (Brazil). Inst. de Geociencias). 1978. 67p. (In Portuguese). NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS. Order Number DE88705267/JAW.

This work reports that the carbon and oxygen isotopic composition separate the mollusks from marine environment of the mollusks from continental environment in two groups isotopically different, making the biological control outdone by environment control, in the isotopic fragmentation mechanisms. The patterns from the continental environment are more rich in O/sup 16/ than the patterns from marine environments. The C/sup 12/ is also more frequent in the mollusks from continental environments. The carbon isotopic composition in paterns from continental environments is situated betwen - 10.31 and - 4,05% and the oxygen isotopic composition is situated between - 6,95 and - 2,41%. To the marine environment patterns the carbon isotopic composition is between - 2,08 and + 2,65% and the oxigen isotopic composition is between - 2,08 and + 0,45%. Was also analysed fossil marine mollusks shells and their isotopic composition permit the formulation of hypothesis about the environment which they lived. (C.D.G.).

11474 **(INIS-BR—1351) Synthesis and characterization of niobium and tantalum by-products with elements of group VI A.** Tsunoda, M. (Pontificia Univ. Catolica do Rio de Janeiro, RJ (Brazil). Dept. de Quimica). (Sociedade Brasileira de Quimica, Sao Paulo, SP). 1986. 2p. (In Portuguese). (CONF-8612170—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88705149/JAW.

From 3. national symposium on inorganic chemistry; Campinas, Brazil (10 Dec 1986).

The development of synthetic process and characterization of new derivates of niobium and tantalum is shown. The Oxidation process and determination of compounds using X-ray diffraction are studied. (M.J.C.).

11475 **(INIS-BR—1387) Uranium separation from urine by solvent extraction to use in fluorimetry.** Mansur Netto, E.; Nunes, S.C.; Mansur, H.N.S.; Dolabela, L. de M.P. (Bahia Univ., Salvador (Brazil)). 1987. 2p. (CONF-8709392—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88705182/JAW.

From 2. International Environmental Chemistry Congress; Salvador, Brazil (16 Sep 1987).

Published in summary form only.

11476 **(INIS-BR—1388) Chromate ion interference in the voltammetric determinations of Zn, Cd and Pb.** Barbosa, A.C.; Cotta, T.A.P.G. (Bahia Univ., Salvador (Brazil)). 1987. 2p. (CONF-8709392—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88705183/JAW.

From 2. International Environmental Chemistry Congress; Salvador, Brazil (16 Sep 1987).

11477 **(INIS-mf—11871) Behaviour of tantalum- and ceramics implants in the organism. Trace element analysis by means of INAA and tracer techniques.** Reich, M. (Koeln Univ. (Germany, F.R.). Mathematisch-Naturwissenschaftliche Fakultaet). 7 Feb 1987. 257p. (In German). NTIS (US Sales Only), PC A12/MF A01. Order Number DE88756364/JAW.

Studies of human and animal tissues after the use of orthopaedic implants were carried out by means of instrumental neutron activation analysis (INAA), as well as studies on the corrosion behaviour of tantalum by means of tracer techniques. After the use of an Al/sub 2/O/sub 3/-ceramic-metal compound prosthesis of the hip joint samples from the joint capsule and the Fascia Lata of 9 patients were studied. The measured Al amounts in the capsule tissues were greater than the normal values by up to 3 orders of magnitude. The corrosion experiment with tantalum was carried out in Ringer's solution as a model of body fluids. Local and systemic changes because of tantalum implants in animal experiments showed massive local stress of the contact tissue as a result of corrosion. Along with this, increased values of Ta were found in the spleen and the liver.

11478 **(IPEN-Pub—130) Determination of trace metals in nuclear-grade uranium dioxide by X-ray fluorescence spectrometry.** Salvador, V.L.R.; Imakuma, K. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo, SP (Brazil)). Apr 1988. 9p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704150/JAW.

A method is described for the simultaneous determination of low concentrations of Ca, Cr, Cu, Fe, Mn and Ni in nuclear-grade uranium dioxide by X-ray fluorescence spectrometry, without the use of chemical treatment. The lower limits of detection range from 2 μg g /sup -1/ for nickel and manganese to 5 μg g /sup -1/ for copper. Samples are prepared in the form of double-layer pellets with boric acid as a binding agent. Standards are prepared in a U/sub 3/O/sub 8/ matrix, which is more chemically stable than UO/sub 2/ and has similar matrix behaviour. The correlation coefficients for calibration curves are better than 0.999. Erros range from 2.4 % for chromium to 6.8 % for nickel.

11479 **(IPEN-Pub—140) Quantitative analysis of a gas mixture using the mass spectrometry technique.** Guimaraes, L.M.F.; Vega Bustillos, J.O.W. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo, SP (Brazil)). Jun 1988. 19p. (In Portuguese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704155/JAW.

The best experimental conditions for a routine qualitative gas analysis by mass spectrometry is the objetive of the presente work. The linear equation method employed in the analysis of the experimental results is discussed. The erros in the analysis are calculated using gases such as CO/sub 2/, N/sub 2/ and CO. The mass spectrometer is tested using synthetic gas mixtures such as Ar-CO/sub 2/, H/sub 2/-N/sub 2/-CO/sub 2/ and Ar-N/sub 2/. A quadrupole mass spectrometer type was used to test performance of the analytical results.

11480 **(IPEN-Pub—149) Transference system of gaseous fluoride compounds for infrared spectrofotometric analysis.** Prado, L. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo, SP (Brazil)). Jul 1988. 19p. (In Portuguese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704159/JAW.

A vacuum line design for transference of gaseous fluoride compounds involved in the uranium hexafluoride infrared analysis is presented. The text include specific comments about the characteristics of each component and about the possibilities of its acquisition in the national market.

11481 **(LA—11435) Determining gallium from plutonium using anion exchange and x-ray fluorescence.** Martell, C.J.; Hansel, J.M. (Los Alamos National Lab., NM (USA)). Dec 1988. Contract W-7405-ENG-36. 13p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004542/JAW.

Gallium in plutonium is determined using anion exchange and x-ray fluorescence. A 6M HCl solution of plutonium, with ascorbic acid added, is passed through an anion exchange resin column. This process sticks the gallium to the resin and allows the plutonium to pass through the column. Zinc, as an internal standard, is pipetted into an empty beaker into which the gallium is eluted with 0.02M HCl. This solution is then evaporated to approximately 2 mL and is transferred to a 10-mL volumetric flask. The solution is poured into an x-ray cell, and the Kα line for both gallium and zinc are read on the x-ray instrument. We then compare the ratio of the intensities for gallium and zinc from a sample with that from standards. The relative standard deviation for the range 0.2% to 1% gallium is 0.36%. 4 refs., 17 figs., 10 tabs.

11482 **(LUNDKL-NKAK—1014-1-135(1987)) Properties of chromatographic peaks and fronts, in particular related to the theory of preconcentration columns for air sampling.** Loevkvist, P. (Lund Univ. (Sweden). Dept. of Analytical Chemistry). 7 Sep 1987. 42p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755780/JAW.

The theory of preconcentration columns is discussed, with special reference to air sampling. The frontal chromatographic process which occur on preconcentration columns and the equations which describe the front shapes are considered. The relation between the capacity of the column (expressed as breakthrough volume) and chromatographic parameters is investigated. Different ways to characterize chromatographic peak shapes is discussed, especially the measurement of retention volume and plate number for columns with low plate numbers. Methods for the evaluation of adsorption isotherms from chromatographic peaks are investigated. The determination of breakthrough volumes by extrapolation from measurements made at elevated temperatures with ordinary gas chromatographic equipment is discussed. The procedure was applied to a method for the sampling of amines in air and compared to data obtained by direct measurements.

11483 **(PNL—6709) Multielement detector for gas chromatography.** Sklarew, D.S.; Evans, J.C.; Olsen, K.B. (Pacific Northwest Lab., Richland, WA (USA)). Nov 1988. Contract AC06-76RL01830. 95p. NTIS, PC A06/MF A01 - OSTI; 1; GPO Dep. Order Number DE89003771/JAW.

This report describes the results of a study to improve the capabilities of a gas chromatography-microwave-induced plasma (GC- MIP) detector system, determine the feasibility of empirical formula determination for simple mixtures containing elements of interest to fossil fuel analysis and, subsequently, explore applications for analysis of the complex mixtures associated with fossil fuels. The results of this study indicate that the GC-MIP system is useful as a specific-element detector that provides excellent elemental specificity for a number of elements of interest to the analysis of fossil fuels. It has reasonably good sensitivity for carbon, hydrogen, sulfur, and nickel, and better sensitivity for chlorine and fluorine. Sensitivity is poor for nitrogen and oxygen, however, probably because of undetected leaks or erosion of the plasma tube. The GC-MIP can also provide stoichiometric information about components of simple mixtures. If this powerful technique is to be available for complex mixtures, it will be necessary to greatly simplify the chromatograms by chemical fractionation. 38 refs., 46 figs., 16 tabs.

11484 **Analytical capabilities of inorganic resonance ionization mass spectrometry.** Young, J.P.; Shaw, R.W.; Goeringer, D.E.; Smithe, D.H.; Christie, W.H. (Oak Ridge National Lab., TN (USA)). *Analytical Instrumentation (New York);* **17**: No. 1, 41(1988). Contract AC05-84OR21400.

The present analytical capabilities of resonance ionization mass spectrometry (RIMS) are discussed. The chronology of the development of the method is described. Examples of RIMS instrumentation are given where possible. The advantages of this technique are presented, and the parameters that currently limit the applicability of RIMS are addressed. Directions for future studies are indicated.

4002 Inorganic, Organic And Physical Chemistry

REFER ALSO TO CITATION(S) 10624, 10627, 11324, 11335, 11415, 11423, 11424, 11428, 11820, 12351

11485 **(AD-A—199760/0/XAB) Kinetic deuterium isotope effects in the combustion of nitramine propellants. Final report, October 1986-July 1988.** Trulove, P.C. (Air Force Astronautics Lab., Edwards AFB, CA (USA)). Jul 1988. 117p. (AFAL-TR—88-072). NTIS, PC A06/MF A01.

The deuterium isotope effect was used to investigate the rate-limiting process in the combustion of nitramine propellants. Model propellant formulations containing either octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX), hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX), or their deuteriated analogues were pressed into pellets and burned under nitrogen pressure in a window bomb. The magnitudes of the observed deuterium isotope effects indicate that the HMX and RDX exert significant control over the burning process of the studied propellants. Furthermore, assuming a consistent mechanism between decomposition and combustion, the observed isotope effects suggest that a carbon-hydrogen bond rupture in HMX and RDX is the rate-controlling process in the combustion of the model nitramine propellants.

11486 **(BNL—41784) Kinetics of the isothermal decomposition of lanthanum nickel hydride.** Reilly, J.J.; Josephy, Y.; Johnson, J.R. (Brookhaven National Lab., Upton, NY (USA)). 1988. Contract AC02-76CH00016. 8p. (CONF-880969—5). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89002905/JAW.

From Metal hydrogen systems fundamentals and applications conference; Stuttgart, F.R. Germany (4 Sep 1988).

The kinetics of the decomposition of the β hydride to the saturated α phase of $LaNi_5H$/sub x/ were determined under isothermal conditions using an agitated suspension of the alloy hydride in n-undecane and n-octane. The kinetics are well described by a shrinking core model where the rate limiting process is the solid state transformation taking place at the β/α interface. The activation energy for the transformation is 40 kJ/mol. The excellent correspondence between the data and the model leads to the conclusion that diffusion is extremely rapid in highly cycled material. The liquid does not take part in any inherent kinetic process, in contrast to the previously studied absorption reaction. However, its presence is necessary to maintain isothermal conditions. 8 refs., 3 figs., 1 tab.

11487 **(DOE/ER/13289—T1) Model heteroatom removal reactions on molybdenum surfaces: Technical progress report.** Friend, C.M. (Harvard Univ., Cambridge, MA (USA). Dept. of Chemistry). 1988. Contract FG02-84ER13289. 7p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005031/JAW.

The reactions of heteroatom-containing molecules on Mo(110) have been investigated under ultra-high vacuum in order to understand the mechanistic details of catalytic heteroatom removal reactions. The experimental approach of our work is to perform comparative studies of a series of structurally related molecules in order to determine how a specific property, such as the C-X(X=S,N or O) bond strength effects reaction selectivity and kinetics. Surface intermediates are identified and structurally characterized using several complementary spectroscopic methods: X-ray photoemission, high resolution electron energy loss, near edge x-ray absorption fine structure (NEXAFS), Auger electron and temperature programmed reaction spectroscopies. Salient results are summarized. 2 figs.

11488 **(DOE/ER/13624—T1) A transient kinetic study of nickel-catalyzed methanation: Final report.** Hoost, T.E.; Goodwin, J.G. Jr. (Pittsburgh Univ., PA (USA). Dept. of Chemical and Petroleum Engineering). Nov 1988. Contract FG02-86ER13624. 39p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number TI89005033/JAW.

The results of this study are in two major parts. In Part I the use of steady-state isotopic transients of multiple elements (C, H, and O) under actual methanation reaction conditions has permitted an assessment of the reactivity of water on a Ni powder catalyst. It was concluded based on the addition of isotopic water that oxygen, once reacted to form water, is able to readsorb even where the surface coverage of CO remains high. At the low relative partial pressures of water used, however, there was no effect of added water on the formation of methane. The surface residence time of water determined from isotopic transients contains the residence time on the surface during the primary formation reaction as well as the time spent during readsorption(s). Part II addressed how a catalyst modifier (in this case Cl) affects methanation in CO hydrogenation using steady-state isotopic transient kinetic analysis (SSITKA) of methanation. The results obtained using silica-supported Ru suggest the structural rearrangements induced by the presence of chlorine, rather than selective site blocking or electronic interactions, may be the primary mechanism of chlorine modification of the catalytic properties of supported metals for CO hydrogenation. SSITKA indicated that the decrease in methanation activity with increasing initial Cl concentration was a function of a decrease in the number of reactive surface intermediates (or sites) and not of a change in site activity. 36 refs., 10 figs., 5 tabs.

11489 **(DOE/ER/13664—2) [Fundamental studies in oxidation-reduction in relation to water photolysis]: Progress report, 1 October 1987--30 September 1988.** Hurst, J.K. (Oregon Graduate Center, Beaverton (USA)). 1988. Contract FG06-87ER13664. 7p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004647/JAW.

Our research over the past year has been focused upon characterizing dynamic processes involving bilayer membranes. Specifically, experiments were directed towards identifying molecular mechanisms of transmembrane oxidation-reduction and "photostimulated" diffusion, a phenomenon that we first described which entails "scrambling" of compartmented membrane-bound reagents accompanying illumination of membrane-bound chromophores. Several studies designed to provide information on the ultrastructural organization and physical properties of membrane-bound dopants that are essential to proper interpretation of the dynamic behavior were also initiated. Finally, in our continuing investigations of dimeric μ-oxo ions as potential catalysts for oxidation of water or redox-active anions, we have critically examined the catalytic capabilities of $[Ru(EDTA)]_2O$ ions, described by others as possessing water-oxidation capabilities in their higher oxidation states.

11490 (DOE/ER/13768—1) Intramolecular energy transfer reactions in polymetallic complexes: Progress report, July 1987--November 1988. Petersen, J. (Clemson Univ., SC (USA). Hunter Chemistry Lab.). Nov 1988. Contract FG09-87ER13768. 5p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004613/JAW.

Research with bimetal complexes is described. Specific areas of research include: Variation of Antenna Donor Energies in the Fe/Ru System; Donor/Acceptor Communication; Cobalt Dihydride Reactive Fragment in a Ru/Co System; Rhodium and Iridium Reactive Fragments; Metal Cluster Systems; and Tridentate Bridges. (CBS)

11491 (INIS-BR—1348) Structural study of compounds in solid state using X-ray diffraction. Lechat, J.R. (Sao Paulo Univ., Sao Carlos, SP (Brazil). Inst. de Fisica e Quimica). (Sociedade Brasileira de Quimica, Sao Paulo, SP). 1986. 2p. (In Portuguese). (CONF-8612170—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88705146/JAW.

From 3. national symposium on inorganic chemistry; Campinas, Brazil (10 Dec 1986).

11492 (INIS-BR—1349) Synthesis of nitridecomplexes with transition metals and determination of its cristalline structure by X-ray diffraction. Hoerner, M. (Santa Maria Univ., RS (Brazil). Dept. de Quimica). (Sociedade Brasileira de Quimica, Sao Paulo, SP). 1986. 2p. (In Portuguese). (CONF-8612170—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88705147/JAW.

From 3. national symposium on inorganic chemistry; Campinas, Brazil (10 Dec 1986).

The Synthesis of nitridecomplexes and type of metal-nitrogen ligation, using X-ray diffraction is studied. Some data on vibrational spectroscopy and crystalline structure are analysed. (M.J.C.).

11493 (INIS-BR—1350) Electron spectroscopy of neodymium and europium complexes; syntheses and chemical studies of niobium (V) compounds. Massabni, A.M.G. (UNESP, Araraquara, SP (Brazil). Inst. de Quimica). (Sociedade Brasileira de Quimica, Sao Paulo, SP). 1986. 2p. (In Portuguese). (CONF-8612170—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88705148/JAW.

From 3. national symposium on inorganic chemistry; Campinas, Brazil (10 Dec 1986).

Some data on characterization and spectroscopic studies of radiation emission and absorption of Nd/sup 3+/ and Eu/sup 3+/ complexes are evaluated. New niobium (V) luminescent compounds are synthetized and the effect os groups of niobium on emissor system is analysed. (M.J.C.).

11494 (LA—11304-C, pp 83-96) **Synthesis and properties of fluorinated parylenes.** Jorgenesen, B.; Cisneros, S.; Jahn, R.; Liepins, R. May 1988. NTIS, PC A 17. Order Number DE88010660/JAW. (CONF-8710302—).

From JOWOG 28A; Los Alamos, NM, USA (6 Oct 1987).

The synthesis of several fluorinated parylenes is presented. Extensive data is presented on the chemical and physical properties of the synthesized compounds.

11495 (LA—11304-C, pp 142-173) **Determination of functional groups in molecular components of polydimethylsiloxanes.** Kohn, E.; Chisum, M.E. (Silas Mason Co., Inc. Amarillo, TX (USA)). May 1988. NTIS, PC A 17. Order Number DE88010660/JAW. (CONF-8710302—).

From JOWOG 28A; Los Alamos, NM, USA (6 Oct 1987).

On-line size exclusion chromatographic (SEC) methods for the determination of silicon hydride (SiH), silanol (SiOH), and silicon phenyl (SiO) funcitonal groups in molecular weight components of polydimethylsiloxanes (PDMS) of the Sylgard type are described. Silicone hydride groups were monitored by means of their IR band near 2160 cm^{-1} and silanol groups were followed by the hydrogen-bonded OH stretching frequency near 3440 cm^{-1}. Phenyl groups were monitored in the UV at 254 nm and quantitated at 215 nm. The methods are illustrated with the results of Sylgards and other commercial samples, some of which have bimodal molecular weight distributions (MWD) and contain specific functional groups in only one of the molecular weight (MW) components. The SiH method was also applied to the quantitation of oligomeric Sylgard prepolymers and was checked by tandem gas chromatography/mass spectrometry (GC/MS).

11496 (LA-UR—88-3687) Conformational changes in polyelectrolytes and the effect on metal binding. Marley, N.A.; Gaffney, J.S.; Minai, Y.; Choppin, G.R. (Los Alamos National Lab., NM (USA)). Sep 1988. Contract W-7405-ENG-36. 15p. (CONF-880912—18). NTIS, PC A03/MF A01 - OSTI. Order Number DE89003474/JAW.

From 196. American Chemical Society national meeting; Los Angeles, CA, USA (25 Sep 1988).

There has been considerable interest in the complexation of metals and other cations by natural humic and fulvic acids, as well as synthetic polyelectrolytes. In order to explain the binding observed for metals, and other species by organic polyelectrolytes, steric effects have been proposed. In this work, the effects of pH changes in aqueous solution on two synthetic polyelectrolytes, polymaleic acid (PMA) and polyacrylic acid (PAA), have been examined by laser Raman spectroscopy and turbidity measurements. These results are compared to Fourier-transform infrared (FTIR) and (^{13}C) nuclear magnetic resonance (NMR) spectra for solid samples of PMA, PAA, and fulvic and humic acids. Two types of carboxylic acid groups were detected for PMA in aqueous solution. Crystallization of PMA in a narrow pH range was observed. These data are consistent with strong intramolecular hydrogen bonding occurring in PMA at a pH of approximately 4. This implication of these results on the use of these compounds as models for fulvic and humic acids is discussed. 27 refs., 3 figs., 1 tab.

11497 (LA-UR—88-3796) Calculated properties and sorption behavior of various molecules. Kober, E.M.; Ritchie, J.P. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 8p. (CONF-8811116—1). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89003576/JAW.

From Scientific conference on chemical defense research; Aberdeen Proving Ground, MD, USA (15 Nov 1988).

We are investigating the relationships between several fundamental molecular properties and a molecule's observed sorption behavior on substrates such as charcoal, which often parallel the molecule's boiling point. We show that the boiling point of a large range of molecules can be predicted from the polarizability, size and dipole moment of the molecules. A more detailed model of the electrostatic and polarization interactions is developed using atom centered multipole expansions (ACME's) of the electron density distribution of a molecule, which is derived from ab initio calculations. We show that these interactions are extremely important for polar molecules and/or substrates, and that they also play a role for "non-polar" molecules such as benzene or ethylene. 10 refs., 5 figs., 2 tabs.

11498 (N—89-11671) Molecular processes in comets. Semiannual progress report No. 21, 1 January-30 June 1988. Dalgarno, A. (Smithsonian Astrophysical Observatory, Cambridge, MA (USA)). Sep 1988. 9p. (NASA-CR—182742; NAS—1.26:182742; SAPR—21). NTIS, PC A02/MF A01.

The transition dipole moments of the c 3 Pi u - a 3 Sigma g +, i 3 Pi g - c 3 Pi u, and i 3 Pi g - b 3 Sigma u + transitions of molecular hydrogen were calculated over a wide range of internuclear distances R. Calculations of the emission spectra are nearing completion. Substantial progress was made in the calculation of the absorption coefficient of a colliding pair of hydrogen atoms in the binary encounter approximation. Detailed calculations were performed on the continuum emission arising from the excitation of the a 3 sigma g + state of H2 by the impact of electrons of various energies. Each curve is labelled by the electron energy in electron volts. The strong emission near Lyman alpha is interesting in that it is produced by excitation of molecular hydrogen.

11499 **(NEI-DK—116) Stylolite formation.** Lind, I. (Danmarks Tekniske Hoejskole, Lyngby. Inst. for Teknisk Geologi). 1988. 271p. NTIS (US Sales Only), PC A12/MF A01. Order Number DE88755797/JAW.

Stylolites are traditionally seen as the result of pressure dissolution. Pressure dissolution is probably at work in the formation of fitted fabric, and may play a role in the formation of stylolites in highly indurated limestones. For stylolites in the porous and easily compactable chalk this theory may not be appropriate. 12 chalk samples from the Dan, Skjold, and Tyra fields of the Danish North sea were chosen for study. The samples bear stylolites, some near horizontal stratiform, and some inclined tectonic. Some samples bear burrowed clay layers of sedimentary origin. The samples were subjected to bulk porosity determination, chemical and mineralogical analysis of bulk sample and insoluble residue, petrography in a hand specimen, thin section, by SEM of the broken surface and polished surface, and, finally, mapping of distribution of porosity and chemical constituents, over selected mm size areas, by the microprobe. Stylolites were found in chalk with porosity of over 40% and with no signs of post stylolite leaching of matrix. The often quoted role of clay as a localizing factor for dissolution is also questinable: Clay rich zones of obvious sedimentary origin may be associated with microstylolites or may not. Apart form the well known depletion in calcite, the stylolites described are depleted in silica. Inclined, tectonic stylolites can not be distinguished from stratiform horizontal by chemistry or mineralogy or porosity distribution. The material of the clay drape shows signs of being transported and recrystallized. 127 refs. (AB).

11500 **(NP—9770182) Contributions to derivative processing of coal oil phenols, with particular regard to selective hydrogenation using Ziegler-Lapporte catalysts.** Fabry, B. (Technische Hochschule Aachen (Germany, F.R.). Mathematisch-Naturwissenschaftliche Fakultaet). 3 Jul 1986. 250p. (In German). NTIS (US Sales Only), PC A11/MF A01. Order Number DE89770182/JAW.

Low-cost raw materials for tertiary crude oil production and nylon production are won by selective alkylation and hydrogenation of the phenols from technical coal oil fractions into alkylphenols and cyclohexanol/on mixtures. The paper on hand deals with the alkylation of the coal oil using cyclic and non-cyclic alkenes as with well as the hydrogenation using different catalysts.

11501 **(SAND—88-2923C) Studies of hydrous sodium titanate ion-exchange materials for use as catalyst supports.** Bunker, B.C.; Peden, C.H.F.; Martinez, S.L.; Braunschweig, E.J.; Datye, A.K. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 21p. (CONF-880912—21). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004822/JAW.

From 196. American Chemical Society national meeting; Los Angeles, CA, USA (25 Sep 1988).

Understanding how the activity of a catalyst is related to the concentration and dispersion of active metals on the catalyst support is critical to designing materials having the optimum catalytic properties. We have developed synthetic techniques for controlling both the concentration and dispersion of nickel on hydrous sodium titanate catalyst supports. The techniques require an understanding of the solution chemistry of both the support material and dissolved metal species (hydrolysis products). In this paper, we present the results of a study of three nickel-loaded samples of hydrous sodium titanate in which the scale of the nickel dispersion ranges from the atomic level to the scale of large (50 nm) clusters. The catalysts are characterized by transmission electron microscopy (TEM), hydrogen chemisorption, and BET surface area measurements. In addition, the activity and selectivity of the Ni catalysts for the n-butane hydrogenolysis reaction is used to monitor the surface structures of Ni in the catalysts. 8 refs., 7 figs., 1 tab.

11502 **(UCID—21588) KINETICS: A computer program to analyze chemical reaction data.** Braun, R.L.; Burnham, A.K. (Lawrence Livermore National Lab., CA (USA)). Nov 1988. Contract W-7405-ENG-48. 10p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89004602/JAW.

KINETICS (Version 2.0) is a copyrighted, user-friendly kinetics analysis computer program designed for reactions such as kerogen or polymer decomposition. It can fit rate parameters to chemical reaction data (rate or cumulative reacted) measured at a series of constant temperatures, constant heating rates, or arbitrary thermal histories. The program uses two models with conversion-dependent Arrhenius parameters and two models with activation energy distributions. The discrete distribution model fits an average frequency factor and relative fractions and activation energies for up to 25 parallel, first-order reactions. The Gaussian distribution model fits a frequency factor, activation energy, Gaussian distribution parameter, and reaction order for up to 3 parallel reactions. For both distribution models, if the experiments are at a series of constant heating rates, the program uses a very fast approximate fitting procedure to determine possible initial parameter estimates for the subsequent nonlinear regression analysis. This increases the probability that the regression analysis will properly converge with a minimum of computer time. Once convergence is reached by the discrete model, the parameter space is further systematically searched to achieve global convergence. With the Gaussian model, the calculated rates or integrals can be convoluted with an experimental tracer signal during the nonlinear regression to account for dispersion effects often found in real chemical reaction data. KINETICS can also be used in an application mode to calculate reaction rates and integrals for previously determined Gaussian or discrete parameters, using an arbitrary thermal history. It is available for PC, VAX, SUN, CRAY computers and can be run interactively or in a batch mode. An auxillary program, PLOTKIN, is available to generate a variety of plots from KINETICS output files.

11503 **(Y—2395) Solubility of hydrogen, deuterium, and tritium in palladium metal.** Powell, G.L.; Laesser, R. (Oak Ridge Y-12 Plant, TN (USA)). 20 Dec 1988. Contract AC05-84OS21400. 41p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005304/JAW.

The solubility of hydrogen, deuterium, and tritium in palladium has been measured, described analytically over a wide temperature range (296 to 1460 K), and used to calculate enthalpies of reaction, isotope separation factors, and phase boundaries. 44 refs., 11 figs., 5 tabs.

11504 **Optical—optical double resonance studies of rotational autoionization of NO.** Pratt, S.T.; Dehmer, J.L.; Dehmer, P.M. (Argonne National Laboratory, Argonne, Illinois 60439). *Journal of Chemical Physics;* **90**: No. 4, 2201-2212(15 Feb 1989).

Optical—optical double resonance spectroscopy is used to probe Rydberg series converging to the first ten rotational levels of NO^+ X $^1\Sigma^+$, $v^+ = 0$. Above the lowest ionization threshold, rotational autoionization of Rydberg series converging to higher thresholds is observed. Predissociation of these Rydberg states is found to compete with rotational autoionization in much the same manner as predissociation competes with vibrational autoionization in the region of the first few vibrational limits of NO^+. The presence of this competing decay process, which has a decay rate similar to that of rotational autoionization, permits the comparison of rotational autoionization rates for different changes in rotational quantum number (ΔN^+). Rotational autoionization by $\Delta N^+ = 2$ is found to be faster than by $\Delta N^+ = 1$ or 3. This results from the requirement that $\Delta N^+ =$ even processes require interactions between levels that both have even or both have odd values of orbital angular momentum l, while $\Delta N^+ =$ odd processes require interactions between levels of which one has even l and the other has odd l. In NO, the latter interactions are known to be quite weak. The electric field dependence and pressure dependence of the ionization threshold are also discussed.

11505 **Efficient molecular simulation of chemical potentials.** Deitrick, G.L.; Scriven, L.E.; Davis, H.T. (Department of Chemical Engineering and Materials Science, University of Minnesota, Minneapolis, Minnesota 55455). *Journal of Chemical Physics;* **90**: No. 4, 2370-2385(15 Feb 1989).

This paper evaluates methods of estimating chemical potential: actually fugacity coefficient: from molecular simulations. These methods are based on formulas given by Widom, by Bennett, and by Shing and Gubbins. They are tested with molecular dynamics simulations of Lennard-Jones liquids along the isotherm $kT/\epsilon = 1.2$

for densities from $0.65\sigma^{-3}$ to $0.90\sigma^{-3}$. A new test molecule sampling method, excluded volume map sampling, is found to be as much as 2 orders of magnitude more efficient than uniform test molecule sampling; it is more efficient and reliable than restricted umbrella sampling proposed by Shing and Gubbins. Several difficulties of estimating the variance of the fugacity coefficient estimates are surmounted by novel application of standard statistical methods. The statistical analysis shows that Bennett's method yields estimates with the least variance and Widom's method yields estimates with the greatest variance although all methods are consistent to within statistical error. Pressure and fugacity coefficient estimates obey the Gibbs—Duhem equation along the chosen isotherm up to densities of $0.75\sigma^{-3}$ for 108-molecule, $0.8\sigma^{-3}$ for 200-molecule, and $0.9\sigma^{-3}$ for 500-molecule simulations.

11506 **Kinetics of a structural phase transition in Langmuir monolayers studied using x-ray diffraction.** Lin, B.; Peng, J.B.; Ketterson, J.B.; Dutta, P.; Thomas, B.N.; Buontempo, J.; Rice, S.A. (Department of Physics and Astronomy, Northwestern University, Evanston, Illinois 60208). *Journal of Chemical Physics;* **90**: No. 4, 2393-2397(15 Feb 1989).

Frequently, time-dependent effects are seen in monolayers of amphiphilic molecules (Langmuir films) when they are compressed, so that the pressure after some time is different from that recorded immediately after compression. We have identified for the first time a microscopic relaxation mechanism in monolayers of heneicosanol ($C_{21}H_{43}OH$): namely, a transition from a uniaxially distorted ("pseudohexagonal") structural, formed upon compression, to an undistorted hexagonal structure. For $T > 20$ °C we observe only an apparently hexagonal phase, while at $T = 5$ °C we observe only an apparently stable pseudohexagonal phase. When $10 \leqq T \leqq 20$ °C, the monolayer structure changes with time from pseudohexagonal to hexagonal. The rate at which this transformation occurs is strongly temperature dependent. We propose that the observed temperature dependence is determined by the rate of nucleation of a hexagonal phase from a metastable shear-induced structure.

11507 **Molecular theories of confined fluids.** Vanderlick, T.K.; Scriven, L.E.; Davis, H.T. (Department of Chemical Engineering and Materials Science, University of Minnesota, Minneapolis, Minnesota 55455). *Journal of Chemical Physics;* **90**: No. 4, 2422-2436(15 Feb 1989).

Density profiles and normal pressures predicted by three different approximate density functional free energy theories and the Fischer—Methfessel approximation to the Yvon—Born—Green (YBG) equation are compared with computer simulation results for fluids confined between planar walls. All models require as input a homogeneous fluid equation of state. Comparisons are made using two mean-field equations of state, one based on a Clausius hard-sphere reference fluid and the other based on a Carnahan/Starling hard-sphere reference fluid. The simplest and oldest of the models, the generalized van der Waals model, becomes unphysical at high mean pore densities. The Carnahan/Starling version of Tarazona model agrees best overall with the simulations. This model represents a systematic improvement on the generalized van der Waals model and is computationally the most complicated of all models examined. The YBG and generalized hard-rod models are not as accurate as the Tarazona model, but they capture the qualitative trends observed in the simulations. Both of these models are intuitive extensions of the exact theory of one-dimensional hard rods, and are computationally much simpler than the Tarazona model.

11508 **Reexamination of energy accommodation experiments using the vibrating surface technique.** Stephens, J.R.; Rosenblatt, G.M. (Los Alamos National Laboratory, Los Alamos, New Mexico 87501). *Journal of Chemical Physics;* **90**: No. 4, 2513-2520(15 Feb 1989).

Measurements of gas/surface energy accommodation using the vibrating surface method have been augmented by experiments which use an infrared sensing technique, rather than a thermocouple, to measure surface temperature. In contrast to previous results no surface temperature rises were detected that can be attributed to gas/surface energy accomodation. A numerical model was developed to simulate the energy flow near the surface of a solid oscillating in a rarified gas. The numerical simulation includes energy exchange between the gas and surface, radiative exchange between the surface and the chamber, and conduction into the solid. Conduction of energy into the solid dominates the surface thermal balance and damps the surface temperature rise due to gas/surface energy exchange to microdegree levels, well below the sensitivity of conventional temperature sensing techniques. Differences between our data and previously reported results are discussed.

11509 **Coherent anti-Stokes Raman spectroscopy of shock-compressed liquid nitrogen.** Moore, D.S.; Schmidt, S.C.; Shaw, M.S.; Johnson, J.D. (Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Journal of Chemical Physics;* **90**: No. 3, 1368-1376(1 Feb 1989).

Vibrational spectra of liquid nitrogen shock compressed to several high pressure/high temperature states were recorded using single-pulse multiplex coherent anti-Stokes Raman scattering. Vibrational frequencies, third-order susceptibility ratios, and linewidths are presented for the fundamental and several excited-state transitions. Vibrational frequencies were found to increase monotonically up to ≃17.5 GPa single shock and ≃30 GPa double shock. Above these pressures, the vibrational frequencies were observed to decrease with further increases in pressure. The decrease in vibrational frequency occurs in a pressure regime where the shocked nitrogen is becoming optically opaque. The consequence of the decrease in vibrational frequency on the Grueneisen mode gamma and its effect on the N_2 equation of state is discussed. The transition intensity and linewidth data suggest that thermal equilibrium of the vibrational levels is attained in less than 10 ns at these high pressures and temperatures. Finally, the measured linewidths exhibit an almost linear dependence on shock temperature, and also suggest that the vibrational dephasing time has decreased to less than 1 ps at the highest pressures.

11510 **Two-reagent reactions of iron clusters with ammonia and deuterium: Saturated compositions and the kinetics of reactions of deuterium with ammoniated clusters.** Hoffman W.F. III; Parks, E.K.; Riley, S.J. (Chemistry Division, Argonne National Laboratory, Argonne, Illinois 60439). *Journal of Chemical Physics;* **90**: No. 3, 1526-1534(1 Feb 1989).

Studies of two-reagent reactions of iron clusters with ammonia and deuterium are described. The compositions of clusters saturated with both ammonia and deuterium have been determined, and indicate that the ammonia binds nondissociatively to iron clusters and to different sites than the deuterium. Rate constants for the reaction of the first deuterium molecule with ammoniated clusters have been measured. In general, low ammonia coverage (one to three molecules) has either little effect on cluster reactivity, or in the case of unreactive bare clusters, increases reactivity dramatically. Clusters saturated with ammonia show general reactivity decreases, although again the least reactive bare clusters show dramatic increases in reactivity when covered with ammonia molecules. Interesting cluster activation and deactivation effects are seen. Possible mechanisms for these reactions are discussed.

11511 **Diffusion-controlled reactions. II. Further bounds on the rate constant.** Torquato, S.; Rubinstein, J. (Department of Mechanical and Aerospace Engineering and Department of Chemical Engineering, North Carolina State University, Raleigh, North Carolina 27695-7910). *Journal of Chemical Physics;* **90**: No. 3, 1644-1647(1 Feb 1989).

We apply variational principles derived earlier by us to obtain rigorous upper and lower bounds on the rate constant k associated with diffusion-controlled reactions among static, reactive traps. We derive a phase-interchanged interfacial-surface lower bound on k and a new type of lower bound which we term a "void" bound. Among other results, we compute the phase-interchanged interfacial-surface bound on k for a distribution of fully penetrable (i.e., randomly centered) spheres in which the trap region is the space exterior to the spheres (the "holes" between the spheres) and diffusion occurs in the sphere region. We also derive an upper bound on k for identical spherical traps (randomly or periodically arranged), and evaluate it for a simple cubic lattice.

11512 **Collocation method for calculating vibrational bound states of molecular systems: with application to Ar—HCl.** Peet, A.C.; Yang, W. (Department of Chemistry, University of California, and Materials and Chemical Sciences Division, Lawrence Berkeley Laboratory, Berkeley, California 94720). *Journal of Chemical Physics;* **90**: No. 3, 1746-1751(1 Feb 1989).

The ability of the collocation method to calculate vibrational bound states of molecules is investigated. The technique is simpler to implement than conventional variational methods; no integration over the basis functions is involved. We apply the method to the weakly bound complex Ar—HCl, a real multidimensional system of considerable physical interest, and find the procedure to be of equivalent accuracy to the corresponding variational approach at all times. This confirms the conclusions of our previous studies on one-dimensional test problems [W. Yang and A. C. Peet, Chem. Phys. Lett. (in press)]. Both low lying and highly excited states are examined and the conclusions hold even for levels very close to the dissociation limit. A test of the wave functions obtained also finds these to be of good accuracy and very similar to the ones given by the variational procedure.

11513 **Molecular dynamics simulation of the optical absorption spectrum of the hydrated electron.** Romero, C.; Jonah, C.D. (Chemistry Division, Argonne National Laboratory, Argonne, Illinois 60439). *Journal of Chemical Physics;* **90**: No. 3, 1877-1887(1 Feb 1989).

The optical absorption spectrum of the hydrated electron was computed at 300 K using the Feynman path integral formulation of quantum statistical mechanics in conjunction with molecular dynamics simulations. In addition, the potential energy of the hydrated electron was studied at 700 K as a function of the liquid density between 0.02 and 1.0 g/cm^3 and correlated with the maximum of the absorption spectrum. The procedure to calculate the optical spectrum makes use of the solution of the Schroedinger equation for an ensemble of model potentials which span the region allowed by the fluctuations of the potential well which traps the electron in thermodynamic equilibrium. The results indicate that the absorption band is due to a strongly allowed 1s→2p transition and the breadth of the spectrum is a consequence of the fluctuations in the trap dimensions. Moreover, these calculations imply that the long tail of the absorption spectrum in the UV arises from electrons which are in deep traps. Such traps occur with low but finite probability in the ensemble of solvent configurations which are accessible to the system in thermal equilibrium. Calculations of the average potential energy of the electron as a function of the density reproduced well the measured shift in the absorption spectrum of the excess electron in water.

11514 **Computer modeling of naphthalene.** Sediawan, W.B.; Gupta, S.; McLaughlin, E. (Department of Chemical Engineering, Louisiana State University, Baton Rouge, Louisiana 70803-7303). *Journal of Chemical Physics;* **90**: No. 3, 1888-1900(1 Feb 1989).

Molecular dynamics simulations have been performed to model naphthalene using an anisotropic two-site pair potential with the interactions between these sites modeled using the modified Gaussian overlap potential. This potential works reasonably well for thermodynamic properties of saturated liquid naphthalene and is shown to be comparable to an isotropic ten-site potential for thermodynamics and microscopic liquid structure. Adding point quadrupoles to the interaction sites further improves the comparison for density of the saturated liquid. However, the effect of electrostatics on thermodynamics in this case is much less than that found earlier for liquid benzene. Feasibility of perturbation theory, for the nonpolar potential, is demonstrated through the reference fluid simulations. Predictive methods are discussed in site frame as well as center frame and in a preliminary testing the latter is shown to be qualitative for predicting the residual Helmholtz free energy. The idea of anisotropic site—site pair distribution function has also been discussed.

11515 **Effects of isotopic substitution on the critical behavior of aqueous solutions of n-dodecylhexaoxyethylene glycol monoether ($C_{12}E_6$).** Wilcoxon, J.P.; Schaefer, D.W.; Kaler, E.W. (Division 1152, Sandia National Laboratory, Albuquerque, New Mexico 87105). *Journal of Chemical Physics;* **90**: No. 3, 1909-1917(1 Feb 1989).

The critical behavior of a nonionic surfactant, n-dodecylhexaoxyethylene glycol monoether (C/sub 12/ E_6) in D_2O, is examined using static and dynamic light scattering and small angle neutron scattering (SANS). Modification of the short-range attractive interactions responsible for phase separation by substitution of D_2O for H_2O has no effect on the measured universal critical exponents describing the divergence of the correlation length ($\nu = 0.6 +- 0.05$) and the isothermal compressibility ($\gamma = 1.2 +- 0.1$) although such substitution results in a reduction of both the nonuniversal amplitudes and critical temperatures. The measured exponents are the same as those of binary molecular fluids. However, in contrast to binary fluids, significant deviations from the Ornstein—Zernike form are observed at intermediate length scales in SANS measurements near the critical point. Isotopic substitution also preserves the dynamic scaling of the Kawasaki form for the measured Rayleigh linewidth, as found previously for H_2 O (Ref. 1). However, this scaling is restricted to a more limited range of distance from the critical point than the static scaling. A maximum in compressibility at the critical isochore is reflected in the concentration dependence of both the compressibility and diffusion coefficient even large distances (~25 °C) from the coexistence curve. Estimates of micelle size, shape, and polydispersity are obtained.

11516 **Theoretical investigation of microscopic dynamics and time scales of predesorption processes.** Muckerman, J.T.; Uzer, T. (Chemistry Department, Brookhaven National Laboratory, Upton, New York 11973). *Journal of Chemical Physics;* **90**: No. 3, 1968-1973(1 Feb 1989).

When an internal mode of an absorbate is excited with enough energy to break the absorbate—surface bond, the adsorbate may desorb in a manner similar to predissociation (or unimolecular reaction) in isolated molecules. In this article, we set up a simple, microscopic model for this "predesorption" process and investigate the influence of various aspects of the model on the time scale of predesorption. These comparisons include quantum mechanical vs classical treatment, and the inclusion vs neglect of surface vibrations. For this simple analog of a "unimolecular reaction," we find that classical mechanics predicts shorter lifetimes; and that the effect of surface vibrations is far less pronounced in quantum mechanics.

11517 **Using multistate dynamical corrections to compute classically exact diffusion constants at arbitrary temperature.** Voter, A.F.; Doll, J.D.; Cohen, J.M. (Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Journal of Chemical Physics;* **90**: No. 3, 2045-2049(1 Feb 1989).

A method is presented for computing the classically exact, surface or bulk diffusion constant of a point defect at arbitrary temperature. The thermal diffusion constant is expressed using the squared jump length averaged over all possible final states to which the atom can jump. The rate constants that weight this sum are computed using transition state theory and molecular dynamics within a recently developed many-state dynamical corrections formalism. While these rate constants are valid only in the rare-event regime (i.e., at low temperature), it is shown that for a periodic lattice of equivalent binding sites, the resulting diffusion contants is valid at any temperature for which the lattice sites remain well defined. It is thus possible to compute classically exact surface or bulk diffusion constant for an arbitrary interatomic potential, without the time scale limitations of direct molecular dynamics.

11518 **Percolative c(2 x 2) adlayer structure in nonequilibrium adsorption models.** Evans, J.W.; Sanders, D.E. (Ames Laboratory, Iowa State University, Ames, Iowa 50011). *Physical Review [Section] B: Condensed Matter;* **39**: No. 3, 1587-1594(15 Jan 1989).

We consider simple adsorption models describing two systems [H_2O on Fe(001) and O_2 on Pd(100)] in which c(2 x 2) short-range order is formed during chemisorption, and metastable satura-

tion states result. This ordering is characterized using concepts from correlated percolation theory. Rapid increases in average domain size near saturation are associated with "ghost percolation thresholds" just above saturation. Generalizing these adsorption models to include an island-forming propensity, α, is shown to move the saturation state closer to c(2 x 2) percolation. The $\alpha \rightarrow \infty$ behavior is elucidated by analyzing corresponding "continuum two-phase grain growth models" using ideas from stochastic geometry, continuum, and random lattice percolation theory.

11519 **Spatial correlations and growth in dilute gels.** Martin, J.E.; Wilcoxon, J.P. (Sandia National Laboratories, P.O. Box 5800, Albuquerque, New Mexico 87185). *Physical Review [Section] A: General Physics;* **39**: No. 1, 252-258(1 Jan 1989).

A series of dilute tetramethoxysilicon gels was made in order to study the spatial correlations that arise from the presence of solvent. Light-scattering measurements from these gels show a fractal structure on length scales as large as 1 μm. The short-length-scale fractal dimension differs from that observed for the connectivity transition at the gel point, indicating a crossover in universality class. Quasielastic light scattering measurements on the incipient gel demonstrate a critical slowing down in the relaxation of concentration fluctuations, causing frozen inhomogeneities in the final gels. Finally, the growth at early times, where the clusters are smaller than the spatial correlation length of the final gel, is shown to be exponential in time, in accord with models of aggregation. It is concluded that a kinetic model of gelation is needed to describe the short-length-scale structures observed in these gels.

11520 (Y/TR—88/4) **4,4'-diaminodiphenylmethanes, process for their manufacture and their use as hardeners for epoxy resins.** Miyagi, Shoichi; Kataoka, Rokuro; Kitakyushu, Shimozaki; Toshiharu, Yukuhashi. (Oak Ridge Y-12 Plant, TN (USA)). 1988. Contract AC05-84OS21400. Translation of German Patent Application No. 2,339,237, February 20, 1975. 12p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004463/JAW.

The invention concerns a process for the manufacture of 4,4'-diaminodiphenylmethanes. They are liquid at room temperature, can be easily mixed with liquid polyepoxides, and the mixtures have a long pot life or processing life. The chlorinated and brominated compounds, can also give the cured products flame-repelling properties. The hardeners contain as an active constituent a 4,4'-diaminodiphenylmethane having the general formula or an eutectic mixture of a compound having the general formula and a diamine, which, with a compound having the general formula, can form an eutectic mixture that is liquid at room temperature such as 4,4'-diamino-3,3'-diethyldiphenylmethane, 4,4'-diaminodiphenylmethane, 4,4'-diamino-3,3'-dichlorodiphenylmethane and 4,4'-diamino-3,3'-dimethyl-diphenylmethane. Candidates for hardening using the 4,4'-diaminodiphenylmethanes are polyepoxides that are produced using a known method by the reaction of a polyvalent phenol, a polyvalent polynuclear phenol or an aliphatic polyvalent alcohol with an epihalohydrin or dihalohydrin in the presence of a base. 1 tab.

4004 Electrochemistry

REFER ALSO TO CITATION(S) 10751, 11263, 11428, 11464, 11685

11521 (Y/TR—88/5) **Production apparatus for ultrafine oxidic particles.** Ito, Toyohito. (Oak Ridge Y-12 Plant, TN (USA)). 30 Sep 1986. Contract AC05-84OS21400. Translation of Japanese Patent Application 63-89,406, 1988. 9p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005358/JAW.

This invention pertains to an ultrafine oxidic particle production apparatus that can easily produce ultrafine oxidic particles whose diameter is 1 μm or less: more specifically, in this ultrafine oxidic particle production apparatus conducting electrodes are dipped in the electrolyte, and current flow is set up between the anode and the cathode. When the limit current is exceeded, the gas adhering to the cathode is dielectrically destroyed, and ultrafine oxidic particles will ultimately be produced on the plasma-liquid surface. 6 figs.

4005 Photochemistry

REFER ALSO TO CITATION(S) 11489, 11490

11522 **Extended measurements of the νZ band of CD_3 and the determination of the vibrational potential function for methyl.** Sears, T.J.; Frye, J.M.; Spirko, V.; Kraemer, W.P. (Department of Chemistry, Brookhaven National Laboratory, Upton, New York 11973). *Journal of Chemical Physics;* **90**: No. 4, 2125-2133(15 Feb 1989).

Measurements in the ν_2 (umbrella) vibrational spectrum of CD_3 are reported. The data include transitions up to and including the $v_2 = 4$—3 bands and cover a wider range of rotational excitation than has been previously reported [Frye, Sears, and Leitner, J. Chem. Phys. 88, 5300 (1988)]. The spectroscopic data have been combined with all previously published data pertaining to the methyl radical and an estimate of the vibrational potential function for the species has been made. From this, we predict the positions of so far unobserved vibrational bands for all the various symmetric isotopic modifications and also extract an equilibrium structure. Preliminary results on the population distribution of v_2 levels produced on the photofragmentation of acetone-d_6 at 193 nm are reported and it is suggested that the methyl $v_3 = 1$ and $v_3 = 0$ levels may be produced in this reaction with a population inversion.

11523 **Evidence for valence hole localization in the Auger decay and fragmentation of carbon and silicon tetrafluorides.** Lapiano-Smith, D.A.; Ma, C.I.; Wu, K.T.; Hanson, D.M. (Department of Chemistry, State University of New York, Stony Brook, New York 11794-3400). *Journal of Chemical Physics;* **90**: No. 4, 2162-2166(15 Feb 1989).

Monochromatic synchrotron radiation was used to excite selectively core electrons of the carbon and fluorine atoms in carbon tetrafluoride and silicon and fluorine in silicon tetrafluoride. The fragmentation processes were examined using time-of-flight mass spectroscopy. The mass spectra show the distribution of ions collected in coincidence with low and high energy electrons. Distinct changes in the mass spectra with atomic site of excitation and photon energy are observed. The observation of F^{2+} ions following fluorine 1s excitation in SiF_4 provides significant evidence for a "valence bond depopulation" mechanism involving the formation of a localized, two-hole final state that persists on the time scale of fragmentation. In contrast, no F^{2+} was observed for CF_4, which indicates that fragmentation for this molecule is more characteristic of a delocalized two-hole state.

4006 Radiation Chemistry

REFER ALSO TO CITATION(S) 10752

11524 **(CEA-CONF—9587) Radiolysis of ammonium hydroxide. Application to pH control in water reactors.** Hickel, B. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Inst. de Recherche Technologique et de Developpement Industriel (IRDI); Dagard, P. (Societe Franco-Americaine de Constructions Atomiques (FRAMATOME), 92 - Courbevoie (France)); Sehested, K. (Centre d'Etudes de Risoe (DK))). (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Inst. de Recherche Technologique et de Developpement Industriel (IRDI)). 1988. 18p. (In French). (CONF-8806286—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756228/JAW.

From Meeting on radiation chemistry; Marly-lo-Roi, France (14 Jun 1988).

Ammonium hydroxide can be used for pH control in the primary coolant circuit of reactor to maintain a value of about 7 reducing corrosion effects. For this application radiolysis of ammonia is studied in the primary coolant circuit of a test reactor of 100 MW for a better simulation of pressure and temperature in a nuclear reactor. Besides activation energy of the reaction: OH + NH/sub 3/ -> NH/sub 2/ + H/sub 2/O is determined by pulse radiolysis, because this reaction is considered as the first step of radiation decomposition of NH/sub 3/ into H/sub 2/ and N/sub 2/.

11525 **(CEA-ORIS-LABRA—076) Effects of ionizing radiations.** Gaussens, G. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Office des Rayonnements Ionisants). Aug 1984. 111p. (In French). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88756236/JAW.

After recalling radiation-matter interaction, influence on radiation effects of chemical composition, structure, irradiation atmosphere, dose rate, temperature of organic materials and evolution of electrical, mechanical and physical properties are reviewed. Then behaviour under irradiation of main organic materials: elastomers, thermoplastics, thermosetting plastics, oils and paints are examined. 68 refs.

4007 Radiochemistry And Nuclear Chemistry

REFER ALSO TO CITATION(S) 11470, 11625, 11861

11526 **(CEA-CONF—9631) Rapid labelling of radiopharmaceuticals using /sup 11/CO/sub 2/ and /sup 11/CH/sub 4/.** Crouzel, C. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Biologie). Jul 1988. 7p. (CONF-880787—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88756230/JAW.

From 3. international symposium on the synthesis and applications of isotopically labeled compounds; Innsbruck, Austria (17 Jul 1988).

In the past two decades, much effort has been devoted to the development of new molecules, labelled with $\beta+$ emitters usable for Positron Emission Tomography. Gaseous forms of /sup 11/C (/sup 11/CO/sub 2/ or /sup 11/CH/sub 4/) must be converted to a reactive form known as a "radioactive precursor": /sup 11/C-methanol, /sup 11/C-formaldehyde, /sup 11/C-acetone, /sup 11/C-phosgene, /sup 11/C-diazomethane, /sup 11/C-methylamine. These precursors are used to label radiopharmaceuticals. Few examples are given: /sup 11/C-prazosin, /sup 11/C-CGP 12177, /sup 11/C-pindolol. Such synthesis procedures require strong initial activity (1.5 Ci). The processes are therefore remotely controlled or automated, and confined to shielded cells. Small laboratory robots have lately been introduced for this type of production.

11527 **(CONF-8801130—1) A new ^{191}Os//sup 191m/Ir generator system for medical use.** Brihaye, C.; Guillaume, M.; Knapp, F.F. Jr. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 5p. NTIS, PC A02/MF A01 - OSTI. Order Number DE89004177/JAW.

From 18. international symposium on radioactive isopopes in clinical medicine and research; Badgastein, Austria (11 Jan 1988).

The use of ultra-short lived single photon emitting radionuclides for angiography offers several advantages including the opportunity to perform rapid repeat studies and a significantly reduced radiation exposure to both patient and personnel. Considering the physical characteristics of the ^{191}Os/^{191}Ir radionuclide pair, a generator system based on this parent-daughter pair presents additional specific advantages. /sup 191m/Ir decays by isomeric transition with a half life of 4.96 sec emitting x-rays and gamma photons, which are compatible with conventional gamma cameras. The short half life of /sup 191m/Ir minimizes the absorbed dose by the patient and permits the injection of a bolus every 30 sec. The ^{191}Os parent decays by β/sup {minus}/ emission with a half life of 15.4 days emitting no gamma photons. The long half life of the ^{191}Os parent makes the useful shelf life of the generator several weeks. A new ^{191}Os//sup 191m/Ir radionuclide generator system which utilizes a heat-treated activated carbon adsorbent has been developed. In the present paper, the preparation, the characteristics, and the use conditions of this generator are described. 4 refs., 2 figs., 1 tab.

11528 **(FRNC-TH—3373) Peptide synthesis by enzymatic catalysis: new application to the total radiosynthesis of the tritiated leucine-enkephalin hormone, using Y carboxypeptidase.** Hellio, F. (Universite de Technologie de Compiegne, 60 (France); CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Biologie). 1986. 148p. (In French). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88756445/JAW.

A new method of enzymatic labelling of peptide hormones is described. The enzyme used, a protease, Y carboxypeptidase is able, in some conditions, to catalyze the formation of peptide bounds. This property has been used for the synthesis of a pentapeptide, the tritiated leucine-enkephalin, with the incorporation of every radioactive amino acid. The specific radioactivity of the labelled molecule is 139 Ci/mmole and its biological properties (receptor binding and immunoreactivity) are identical with native leucine-enkephalin properties.

11529 **(IPNO-DRE—88-15) Prospects in radiochemistry.** Guillaumont, R. (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire). 1988. 21p. (In French). (CONF-8805245—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756252/JAW.

From 1988 IN2P3 meeting; Villars de Lans, France (1 May 1988).

This paper draws the basic research direction concerning activities with or on radionuclides related only to chemistry that is to say taking into account degrees of oxidation or valence. Chemical behaviour of very diluted element or even of one atom only, present trends and importance of radiochemistry in the fuel cycle are reviewed.

11530 **(IPNO-T—88-02) Comparative study of α and β-ThBr/sub 4/: structure and luminescence. Spectroscopy of U/sup 4+/ in α-ThBr/sub 4/.** Simoni, E. (Paris-11 Univ., 91 - Orsay (France)). May 1988. 117p. (In French). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88756254/JAW.

UV absorption of β-ThBr/sub 4/: presents a plain absorption front and for the same temperature the threshold energy has the same value than the threshold energy of excitation function and photocurrent peak. Emission intensity and lifetime decrease when temperature increases from 300 K to 400K (extinction temperature). Results are interpreted either by molecular orbital levels of the ThBr/sub 8//sup 4-/ cluster or either by conduction and valence bands of the matrix above. Absorption and emission spectra of U/sup 4+/ in α-ThBr/sub 4/ (where U/sup 4+/ has a S/sub 4/ symmetry) between 300 K and 4.2 K allow indexation of 30 levels. Spectroscopic parameters are calculated in D/sub 2d/ and S/sub 4/ symmetry. Comparison of these parameters with those of U/sup 4+/ in β-ThBr/sub 4/ and β-ThCl/sub 4/ shows that crystal field force is practically the same in the three matrices but the structure transformation from β to α has more influence on B/sub q/sup k/ than ligand change from Br/sup -/ to Cl/sup -/. Owing to very low phonon energy, fluorescence spectra of U/sup 4+/ is easy to observe in α-ThBr/sub 4/ as it is in β-ThBr/sub 4/ and ThCl/sub 4/.

11531 **(ISH—119) Chromatographic check of radiochemical purity of Tc-99m methylenediphosphonat (MDP), Tc-99m diethyleneaminopentaacetic acid (DTPA), I-131/I-123 metaiodobenzylguanidine (MIBG), and I-123 iodoamphetamine (IAMP).** Hammermaier, A.; Reichert, T.; Reich, E.; Boegl, K.W. (Bundesgesundheitsamt, Neuherberg (Germany, F.R.). Inst. fuer Strahlenhygiene). Nov 1987. 114p. (In German). Bundesgesundheitsamt, Neuherberg (Germany, F.R.). Inst. fuer Strahlenhygiene.

The purpose of the present study is to examine radiochemical impurities in nine MDP and DTPA kits distributed by different producers and labeled with Tc-99m. Five I-123/I-131 MIBG or amphetamine products from three producers were also impurity tested, together with the in vitro stability of these radiopharmaceuticals. Paper and thin-layer chromatography was used for analysis, next to a position sensitive gas flow counter for measuring the radioactivity distribution on the chromatograms. The study of Tc-99m MDP and TPA basically showed two different radioactive impurities: free pertechnetate and hydrolysed technetium. Free pertechnetate was observed in only a few of the samples: the values were less than 1% of total radioactivity in all cases. Radioiodine labeled MIBG had a free iodide impurity of 1-2.5% of total activity, showing traces of also a second impurity. The radiochemical purity study of I-123 amphetamines resulted in free iodide values of about 1.5%.

4008 Combustion, Pyrolysis, And High-temperature Chemistry

REFER ALSO TO CITATION(S) 10841, 11135, 11485, 11494

11532 (LUTMDN/TMVK—3131-1-53(1988)) Modelling of combustion kinetics in a well stirred reator. Klingmann, J. (Lund Inst. of Tech. (Sweden). Div. of Heat and Power Engineering). Jan 1988. 54p. (In Swedish). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88755781/JAW.

A computer program is described, that models the combustion kinetics in an ideal combustion chamber without concentration- and temperature gradients, i.e. a well stirred reactor. The report comprises a manual for the computer code a an example from a calculation of the emission of nitrogen oxides. The computer code is based on the CHEMKIN code. (L.E.).

11533 (N—89-11153, pp 181-193) Modeling of combustion processes of stick propellants via combined Eulerian-Lagrangian approach. Kuo, K.K.; Hsieh, K.C.; Athavale, M.M. Jul 1988. NTIS, PC A09/MF A01. (NASA-CP—3006; M—591; NAS—1.55:3006; CONF-880250—).

From Transport processes in dispersed two-phase flows with applications to propulsion systems; Huntsville, AL, USA (25 Feb 1988).

This research is motivated by the improved ballistic performance of large-caliber guns using stick propellant charges. A comprehensive theoretical model for predicting the flame spreading, combustion, and grain deformation phenomena of long, unslotted stick propellants is presented. The formulation is based upon a combined Eulerian-Lagrangian approach to simulate special characteristics of the two phase combustion process in a cartridge loaded with a bundle of sticks. The model considers five separate regions consisting of the internal perforation, the solid phase, the external interstitial gas phase, and two lumped parameter regions at either end of the stick bundle. For the external gas phase region, a set of transient one-dimensional fluid-dynamic equations using the Eulerian approach is obtained; governing equations for the stick propellants are formulated using the Lagrangian approach. The motion of a representative stick is derived by considering the forces acting on the entire propellant stick. The instantaneous temperature and stress fields in the stick propellant are modeled by considering the transient axisymmetric heat conduction equation and dynamic structural analysis.

11534 (PB—89-122378/XAB) Direct measurement of heat of gasification for polymethylmethacrylate. Jackson, J.L. (National Inst. of Standards and Technology (NEL), Gaithersburg, MD (USA). Center for Fire Research). Oct 1988. 39p. (NISTIR—88/3809). NTIS, PC A03/MF A01.

A laboratory-scale apparatus was developed for the direct measurement of the heat of gasification for solid fuels. The apparatus was designed to simulate radiant energy transfer rates found under actual fire conditions and designed in such a way that the energy gains and losses with respect to the sample surfaces are well defined. Calculation of the time dependent heat of gasification for solid fuels relies on the ability to measure accurately and continuously the time dependent energy transfer rates and material responses. Tests were conducted in which samples of polymethylmethacrylate were subjected to incident heat fluxes ranging from 1 to 4 W/sq cm. Test results indicate that, under these conditions, the heat of gasification is significantly influenced by the time-dependent thermal properties of the material and approaches an asymptotic value that varies with incident heat flux. The asymptotic values decrease with increasing incident heat flux and approach a value of 1600 J/g consistent with values published by other investigators. Refinement of the apparatus and the testing of other materials is continuing. Results for two additional materials, fir and oak are included as Appendix A.

42 ENGINEERING

11535 (LBL—26045) The identity of our profession. Denn, M.M. (Lawrence Berkeley Lab., CA (USA)). Oct 1988. Contract AC03-76SF00098. 13p. (CONF-8810237—1). NTIS, PC A03/MF A01 - OSTI. Order Number DE89002962/JAW.

From MIT centennial of Chemical Engineering Education symposium; Cambridge, MA, USA (5 Oct 1988).

This paper discusses the direction in which the profession of chemical engineering is heading. 9 refs. (LSP)

4202 Facilities And Equipment

REFER ALSO TO CITATION(S) 10781, 10792, 11267, 11276, 11383, 11603, 11611, 12445, 12446, 12492

11536 (AD-A—198465/7/XAB) Mega-amp opening switch with nested electrodes/pulsed generator of ion and ion-cluster beams. Annual report (Final), 1 June 1986-30 June 1987. Nardi, V. (Stevens Inst. of Tech., Hoboken, NJ (USA)). 30 Jul 1987. 39p. (SIT-AFOSR-N—85.86.87-1). NTIS, PC A03/MF A01.

The use of a plasma focus as a mega-amp opening switch was demonstrated by two modes of operation: (a) single-shot mode; (b) repetitive mode with a repetition rate of 0.1-1-1 MHz. The peak current in (a) was about 0.6 MA (from a 8 kJ capacitor bank at 18 kV) and in (b) about 0.2 MA (from a 40 kJ pulse forming network at about 40 kV). A voltage multiplication by a factor somewhat > 7 was observed during the 0.1 us opening stage in (a), and by a factor somewhat > 2.4 in (b). The use of field distortion elements (FDE) in the interelectrode gap indicates that the neutron yield (from D-D fusion reactions; deuterium filling of the discharge chamber) increased by a factor 10 as compared to the yield of the same system operating at the same energy level and under the same voltage and filling-pressure conditions but without field distortion elements. Misfirings of the plasma focus machine are also virtually eliminated by using FDE at the coaxial electrode breech. The tests (based on about 10000 shots and five plasma focus machines) demonstrated that a sizable amount of nuclear reactions with high-Z nuclei (C,N) are induced by the MeV D(+) ions which are accelerated and trapped in the pinch when entered in the filling gas D_2+1-15% of carbon (or nitrogen) atoms. The observed reaction yield for high-Z nuclei is increased by suitable FDE's and is about 3% of the D-D fusion reaction yield. The neutron yield Y provides for all shots a good quantitative estimate of the performance of the plasma focus as an opening switch, i.e., Y is strongly correlated with the drop of the electrode current during the opening stage. (JHD)

11537 (AD-A—199074/6/XAB) Program manager's guide to producing nuclear, biological, and chemical contamination survivable systems. Report for January-May 1988. Feeney, J.J. (Chemical Research, Development and Engineering Center, Aberdeen Proving Ground, MD (USA)). Sep 1988. 27p. (CRDEC-SM—2). NTIS, PC A03/MF A01.

Each DOD component has been tasked with assessing NBC contamination survivability and identifying vulnerabilities and associated risks for systems with NBC contamination survivability requirements. This report is intended to guide DOD combat and materiel developers and their contractors in understanding the survivability requirements needed in designing for and determining the NBC contamination survivability of military equipment.

11538 (CEA-CONF—9609) Fiber optic link for the remote handling in nuclear environment. Breuze, G.; Carnet, B.; Friant, A.; Blanc, F.; Lordet, J.; Boisde, G. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. d'Electronique et d'Instrumentation Nucleaire; CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Genie Radioactif). 1988. 6p. (In French). (CONF-8805121—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88756229/JAW.

From OPTO '88; Paris, France (17 May 1988).

At CEA a R/D program is running to improve performances of servomanipulators used in nuclear fuel reprocessing plants. Present work gives the main environmental parameters (gamma rays exposition, temperature) and shows the basis of the digital link designed to remote-handle such a manipulator. Up to 10/sup 5/ Gy behavior of optical fibers and electronic components was studied. Two different optical cables were built, one for the long link (100 m), the second to set in an especially designed winding unwinding wheel. Six way permanent or remote-handle connectors were developed to connect optical interfaces and a leaktight penetration. Measured budget of the link taking into account efficient photobleaching of the pure silica core fiber and influence of gamma rays on the slave interface is presented.

11539 **(CEA-tr—2260) Robot for measuring at a distance the external diameter and the defects in an irradiated fuel pin clads.** Kanashov, B.A.; Leshchinskii, A.G. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Nov 1987. 6p. (In French). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88756241/JAW.

At the NIIAR Institute, in a hot cell of the complex, is settled a robot for measuring, at a distance, the external diameter and the defects of an irradiated fuel pin clad. The principal diagram is given in this document.

11540 **(CONF-890153—2) The Laboratory Telerobotic Manipulator program.** Herndon, J.N.; Babcock, S.M.; Butler, P.L.; Costello, H.M.; Glassell, R.L.; Kress, R.L.; Kuban, D.P.; Rowe, J.C.; Williams, D.M. (Oak Ridge National Lab., TN (USA)). 1989. Contract AC05-84OR21400. 20p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005108/JAW.

From NASA conference on space telerobotics; Pasadena, CA, USA (31 Jan 1989).

New opportunities for the application of telerobotic systems to enhance human intelligence and dexterity in the hazardous environment of space are presented by the National Aeronautics and Space Administration (NASA) Space Station Program. Because of the need for significant increases in extravehicular activity and the potential increase in hazards associated with space programs, emphasis is being heightened on telerobotic systems research and development. The Automation Technology Branch at NASA Langley Research Center currently is sponsoring the Laboratory Telerobotic Manipulator (LTM) program at Oak Ridge National Laboratory to develop and demonstrate ground-based telerobotic manipulator system hardware for research and demonstrations aimed at future NASA applications. The LTM incorporates traction drives, modularity, redundant kinematics, and state-of-the-art hierarchical control techniques to form a basis for merging the diverse technological domains of robust, high-dexterity teleoperations and autonomous robotic operation into common hardware to further NASA's research. 4 refs., 12 figs.

11541 **(CONF-8811132—1) Spatial reasoning in the treatment of systematic sensor errors.** Beckerman, M.; Jones, J.P.; Mann, R.C.; Farkas, L.A.; Johnston, S.E. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 12p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89003244/JAW.

From Conference on sensor fusion: spatial reasoning and scene interpretation; Cambridge, MA, USA (6 Nov 1988).

In processing ultrasonic and visual sensor data acquired by mobile robots systematic errors can occur. The sonar errors include distortions in size and surface orientation due to the beam resolution, and false echoes. The vision errors include, among others, ambiguities in discriminating depth discontinuities from intensity gradients generated by variations in surface brightness. In this paper we present a methodology for the removal of systematic errors using data from the sonar sensor domain to guide the processing of information in the vision domain, and vice versa. During the sonar data processing some errors are removed from 2D navigation maps through pattern analyses and consistent-labelling conditions, using spatial reasoning about the sonar beam and object characteristics. Others are removed using visual information. In the vision data processing vertical edge segments are extracted using a Canny-like algorithm, and are labelled. Object edge features are then constructed from the segments using statistical and spatial analyses. A least-squares method is used during the statistical analysis, and sonar range data are used in the spatial analysis. 7 refs., 10 figs.

11542 **(DOE/NE/37968—1) A 2-D and 3-D robot path planning algorithm based on quadtree and octree representation of workspace.** Hyder Ali, A.K.; Abidi, M.A. (Tennessee Univ., Knoxville (USA). Dept. of Electrical and Computer Engineering). 1988. Contract FG02-86NE37968. 6p. (CONF-880433—8). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005014/JAW.

From Southeastcon '88 conference and exhibit; Knoxville, TN, USA (11 Apr 1988).

A 2-D and 3-D path planning algorithm for robot navigation and manipulation is developed in this paper. This method is of particular interest for robotic systems which require both 2-D navigation to reach the work site and 3-D path planning for on-site manipulation and inspection. This study extends the approach of 2-D path planning to 3-D with minimum effort. The quadtree and octree structures are used for 2-D and 3-D workspace representation, respectively. Quadtrees and octrees are generated from brightness image of the workspace obtained using a camera mounted on a robot. Path generation is based on the A* algorithm. The spatial length and the clearance space available for the robot are used as constraints in the path generation. The results of this approach are illustrated through an experimental system setup on a robotic workstation. 12 refs., 11 figs.

11543 **(DP-MS—88-175) Vision/viewing development status, Savannah River Plant.** Heckendorn, F.M.; Veenema, P. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Plant). 1988. Contract AC09-76SR00001. 21p. (CONF-8810175—2). NTIS, PC A03 - OSTI. Order Number DE89005165/JAW.

From JOWOG 39-manufacturing technology - SUBWOG F-robotics conference; Santa Fe, NM, USA (4 Oct 1988).

The Savannah River Laboratory (SRL) continues to provide support to the Savannah River Plant (SRP) in many areas of Robotics and Vision/Viewing. An overview of the work recently completed or now in progress in the Vision/Viewing areas is provided below. The nature of the work at SRP has indicated the need for both vision systems related to classic robotics and viewing systems of a specialized nature. The latter concerns the maximizing of information gathering and control efforts in radiation environments not suitable for continued human presence. The following sections will address these applications separately. 17 figs.

11544 **(DTH-DCAMM—370) Large deflection upheaval buckling of marine pipelines.** Terndrup Pedersen, P.; Michelsen, J. (Danmarks Tekniske Hoejskole, Lyngby. Danish Center for Applied Mathematics and Mechanics). Mar 1988. 21p. Available on loan from Risoe Library, DK-4000 Roskilde.

It is the purpose of this paper to present a non-linear analysis procedure which can be used to determine the strains and the deflections in a buried, heated marine pipeline which has suffered thermal buckling such that the pipeline over a certain distance has penetrated the sea bottom. A detailed analysis of this final buckling event is necessary in order to determine the cause for an upheaval event and forms the basis for decisions concerning possible continued operation until remedial action can be taken. The mathematical model includes in a consistent manner the important nonlinearities caused by: the elastic-plastic behaviour of the pipeline material, the geometric non-linearities caused by the large deflections, the variation of the soil uplift resistance with the pipeline displacements, and the variable or deformation dependent axial resistance forces.

11545 **(EGG-M—00487) Computer control of gas metal arc welding.** Smartt, H.B.; Einerson, C.J.; Watkins, A.D. (EG and G Idaho, Inc., Idaho Falls (USA)). 1988. Contract AC07-76ID01570. 13p. (CONF-880686—2). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005188/JAW.

From Computer technology in welding; Cambridge, UK (8 Jun 1988).

The state of an arc weld is determined by the composition of the weld and base metal and its thermomechanical history. The composition of the deposited weld metal depends primarily on the amount of filler metal dilution which occurs. The heat input to the weld, comprising pre-heat and process heat, is the controlling factor in the thermal cycle to which the material responds metallurgically, to produce a specific set of weld properties. Thus, control of the arc welding process should focus on rational specification and real-time control of the heat and mass input to the weld. A process control model has been developed for the gas metal arc welding (GMAW) process using the state variables, time-domain method. The governing equations have been solved for the process parameters as functions of the desired heat input (in terms of heat per unit length) and mass input (in terms of transverse reinforcement area) to the weld. The resulting nonlinear model has been used with a simple proportional controller with deadband and variable coefficients to control the weld heat input and reinforcement area independently. A welding machine has been developed for this work, consisting of a computer-controlled welding head, positioning table, and operator panel, which is the front end for a conventional 300 A constant voltage power supply. Software for the system is written in the HPL language. System components communicate over an IEEE-488 bus. 9 refs., 6 figs.

11546 **(EGG-M—88049) Noncontact ultrasonic sensing of weld pools for automated welding.** Johnson, J.A.; Carlson, N.M. (EG and G Idaho, Inc., Idaho Falls (USA)). 1988. Contract AC07-76ID01570. 8p. (CONF-881081—1). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005185/JAW.

From Meeting on nondestructive characterization of materials; Saarbrucken, F.R. Germany (3 Oct 1988).

Contacting ultrasonic techniques can determine the geometry of the molten/solid interface and detect conditions which could lead to defect formation. However, the couplant required is a potential source of contamination in the weld and may be difficult to use under industrial conditions. Stress waves can also be generated and detected using noncontacting techniques. Ultrasonic stress waves are generated by focusing a beam from a pulsed laser on a stationary weld pool formed on the surface of a steel plate or on a weld pool in a fillet weld. The transmitted ultrasound is detected by an electromagnetic-acoustic transducer (EMAT). The signal received by the EMAT provides information about the properties of the pool, including the geometry and defect generating conditions. This information can be input to an intelligent controller. The ultrasonic system described in this paper is being developed as a portion of the sensing and control system for a completely automated welder. 11 refs., 5 figs.

11547 **(EGG-M—88168) Laser detection of acoustic displacements by destabilizing a frequency stablized helium neon laser.** Barna, B.A.; Tow, D.M.; Allemeier, R.T.; Rodriguez, J.G.; Johnson, J.A. (EG and G Idaho, Inc., Idaho Falls (USA)). 1988. Contract AC07-76ID01570. 7p. (CONF-880760—7). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005282/JAW.

From Review of progress in quantitative nondestructive evaluation; La Jolla, CA, USA (31 Jul 1988).

A sensor for detecting low-amplitude acoustic displacements is described. This instrument is based on a stabilized helium-neon laser and is capable of measuring submicron displacements of diffuse surfaces at distances of up to 10 m and with a bandwidth between 0.2 and 100 kHz. The potential for extension of the technique to higher frequencies is discussed. The sensor uses the inherent sensitivity of an alternate-mode balanced, frequency-stabilized laser to small amounts of retroreflected light. Applications of the sensor include a study of bonding flaws in complex multilayer materials, such as the thermal protection tiles on the Space Shuttle Orbiter and in graphite epoxy laminar composites. 3 refs., 4 figs.

11548 **(Juel—2224) Theoretical and experimental investigations of creep buckling on NiCr 22 Co 12 Mo tubes.** Ahmed, K.; Breitbach, G.; Over, H.; Schubert, F.; Nickel, H. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorwerkstoffe; Technische Hochschule Aachen (Germany, F.R.)). Aug 1988. 121p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88756377/JAW.

Doctoral thesis submitted by K. Ahmed.

The postulated pressure loss of the secondary circuit is one of the hardest loading conditions for the heat exchanging components in a HTGR plant. It is to proof for the design that the heat exchanging metallic components (heat exchanger or reformer tubes of a PNP plant for instance) do not collapse under such an emergency condition. An external pressure p/sub a/ stressed tubes or cylindric shells at a pressure loss of a secondary circuit side. This external pressure buckles the tubes in dependence of the fabrication implied out of roundness /sub 0/ (fabrication tolerances) by material creep in the high temperature region. This creep buckling ends in a failure (collapse) of the component after a critical time t/sub cr/. The aim of the work is the experimental verification of creep buckling behaviour for the heat exchanger components and the comparison with different constitutive equations. With these equations safety factors can be formulated against as well the critical collapse time and pressure as the permissible out of roundness from fabrication.

11549 **(LITH-EKI-EX—56) Computer simulation of the drying process and technical/economical aspects of copra dryers in the republic of Seychelles.** Bauer, B.; Karlsson, M. (Linkoeping Univ. (Sweden). Dept. of Management and Economics; Linkoeping Univ. (Sweden). Dept. of Mechanical Engineering). Nov 1987. 184p. (LITH-IKP-EX—671). NTIS (US Sales Only), PC A09/MF A01. Order Number DE88755778/JAW.

In the republic of Seychelles, coconut meat is dried to become copra. The main reason for this drying is that dried coconut meat, copra, does not become rancid in store or during transport and it remains free from moulds and insect damage. Our purpose was to study the technical and economical conditions of four different dryers and to do an experimental computer simulation of the drying process. The results with the study are: technical and economical recommendations for the choice of dryers for the future in the republic of Seychelles. An experimental computer simulation of the drying process for one of the dryer alternatives. (authors).

11550 **(MIT—9005561) Study of the influence of filler wire carbon and residual element content on the mechanical properties of mechanized gas-metal-arc-welds: Final report.** (Microalloying International, Inc. (USA)). Jun 1988. 110p. American Gas Association, Order Processing Department, 1515 Wilson Boulevard, Arlington, VA 22209-2470. Order Number TI89005561/JAW.

The individual and interactive roles of carbon, oxygen, and nitrogen and residual or tramp elements such as titanium, chromium, copper, sulfur, phosphorus, aluminum, arsenic, tin, and antimony on weld metal mechanical properties in pipeline steels are poorly documented. Further, most of the research has been done with the submerged-arc process. Systematic studies of the microstructures and toughnesses of GMAW welds are limited. A better understanding of the effects of carbon and the residual elements on weld metal toughnesses is needed so that appropriate filler wires can be produced. Accordingly, the objective of this research program was to attempt to determine the reason for the variable toughness of mechanized gas-metal-arc (GMA) girth welds and to identify means of improving toughness levels, particularly CTOD test values. This report is available from the American Gas Association Order Processing Department, 1515 Wilson Boulevard, Arlington, VA 2209-2470 (703/841-8558). 5 refs., 36 figs., 9 tabs.

11551 **(NEI-DK—100) Expansion- and tension conditions for preinsulated district heating pipes, phase 2.** (Hoejlund Rasmussen (B.) Raadgivende Civilingenioerer, Copenhagen (Denmark); Danmarks Tekniske Hoejskole, Lyngby. Afdelingen for Baerende Konstruktioner). Jan 1988. 63p. (In Danish). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88755783/JAW.

The purpose of this project has been to examine preinsulated tees located in soil under an axial load. The results are compared with the theories in chapter 2 and 5.4.4 of (1). In the tests the soil has been modelled by placing the tee in a cylindrical shell made from PU-foam of appropriate stoffness. Chapter 1 is an introduction to and chapter 2 a summary of the report. Chapter 3 describes the tees and the test equipment. Chapter 4 deals with the stiffness of the PU-foam shells. Chapter 5 compares the number of cycles to failure predicted by theory with that observed during the test. Chapter 6 compares the stress-intensification factors predicted by theory with those calculated from the test results. Chapter 7 describes the types of failure observed. Chapter 8 deals with the straingauge measurements. Chapter 9 sums up the test results. The fatigue tests show that the fatigue strength of the tees under an axial load is higher than predicted. The stringauge measurements however are not lower than predicted, which leads to the assumption that the endurance strength-formula in use is conservative. The test results indicate that the endurance strength stated in chapter 2 of (1) could be increased by 33 pct. Caution should however be taken because of the low number of tests performed.

11552 **(NUREG—0383-Vol.3-Rev.8) Directory of certificates of compliance for radioactive materials packages: Report of NRC approved quality assurance programs for radioactive material packages.** (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Safeguards and Transportation). Dec 1988. 196p. NTIS, PC A09/MF A01 - GPO - OSTI. Order Number TI89005715/JAW.

This directory contains a Report of the US Nuclear Regulatory Commission's Approved Packages (Volume 1), all Certificates of Compliance (Volume 2), and a Report of NRC Approved Quality Assurance Programs (Volume 3) for Radioactive Material Packages effective October 1, 1988. The purpose of this directory is to make available a convenient source of information on packagings which have been approved by the US Nuclear Regulatory Commission. To assist in identifying packaging, an index by Model Number and corresponding Certificate of Compliance Number is included at the front of Volume 2 of the directory. A listing by packaging types is included in the back of Volume 2. An alphabetical listing by Company name is included in the back of Volume 3 for approved QA programs. The Reports include a listing of all users of each package design and approved QA programs prior to the publication date of the directory.

11553 **(SAND—87-2645) Instrumentation uses to determine structural responses under various test conditions.** Gonzales, A. (Sandia National Labs., Albuquerque, NM (USA)). Jan 1989. Contract AC04-76DP00789. 40p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005297/JAW.

Sandia National Laboratories standardly approaches design and analysis problems by testing various components and prototypes. Instrumentation is used in impact, dynamic, and static testing to gather information about the structural response of a component or prototype. This report describes the most common measurement devices used, and discusses the uncertainties associated with the reduced data. 12 refs., 13 figs., 2 tabs.

11554 **(SVF—300) Coal bunkers - Problem analysis - Coal flow.** Eriksson, L.; Leven, P.; Lysedal, P. (AaF Energikonsult AB, Stockholm (SE)). (Stiftelsen foer Vaermeteknisk Forskning, Stockholm (Sweden)). Apr 1988. 84p. (In Swedish). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88755921/JAW.

In Swedish plants it is not always possible to buy the same sort of coal. Therefore it is necessary to buy equipment (bunkers and feeders) that can handle all qualities of coal. Coal bunkers are to be designed for massflow, that is all coal in the bunker must move at the same time. The English coal bunker philosophy says, however, that massflow design can give strong bridges of coal. The geometrical shape of a coal bunker in practise always will be a compromise between ideal flow, building engineering and economy. Lining of the coal bunkers with an ultra high molecular polyethylene seems to be a good measure if the geometrical shape of the bunker is not convenient or if corrosion problems will arise. However, the impact strength of plastic is limited. Experiences point towards acid proof steel. The extraction opening in the bottom of the bunker down to the feeder must be as big as possible, alternatively the bottom should be divided in more than one shaft. A relatively new design is based on plates that are installed so that the output will be wedge-shaped in the working direction for the feeder. In that way better conditions for the complete volume of the bunker to take part in the coal stream is reached, i.e. massflow is achieved. Dampers, operated hydraulically or manually handled, seem to be the best kind of shut off arrangements. When coal with good flow rate is used the chain feeder seems to give a satisfactory function. Air guns are one of the best and most common facilities to stimulate the coal flow. To function well the air guns must be properly placed and fired in the right sequence. (authors).

11555 **(UCID—21158) Elimination of bending in dielectric mirrors with applications to correction of phase front distortion caused by laser heatings in windows.** Hunt, J.T. (Lawrence Livermore National Lab., CA (USA)). 28 Aug 1987. Contract W-7405-ENG-48. 9p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005500/JAW.

An important consideration in the design of high power laser optical systems is controlling the aberrations produced by laser heating. The largest of these aberrations is caused by the bending of the optic. The source of the bending is absorption of the beam by the thin film reflecting coating. The subsequent diffusion of this energy into the substrate produces a longitudinal temperature gradient in the substrate and causes it to bend in a manner similar to a heated bimetallic strip. This paper discusses a way to eliminate this bending. 1 tab.

11556 **(WHC-SA—0244) Abrasive water-jet cutting; remote hot cell application.** Leist, K.J.; Funnell, G.J. (Westinghouse Hanford Co., Richland, WA (USA)). Sep 1988. Contract AC06-87RL10930. 4p. (CONF-880903—46). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004905/JAW.

From Spectrum '88: international topical meeting on nuclear and hazardous waste management; Pasco, WA, United States (11 Sep 1988).

In the process of selecting a failed equipment cut-up tool for the Process Facility Modifications (PFM) Project, a system using an Abrasive Water Jet (AWJ) was developed and tested for remote disassembly of failed equipment by the Westinghouse Hanford Company, PFM Mechanical Development Unit.

11557 **A corrosive resistant heat exchanger.** Richlen, S.L. US Patent Application 6-083,340. 10 Aug 1987. 19p. Contract AC07-76ID01570. DE89000161 NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE89000161/JAW.

A corrosive and erosive resistant heat exchanger which recovers heat from a contaminated heat stream. The heat exchanger utilizes a boundary layer of innocuous gas, which is continuously replenished, to protect the heat exchanger surface from the hot contaminated gas. The innocuous gas is pumped through ducts or perforations in the heat exchanger wall. Heat from the heat stream is transferred by radiation to the heat exchanger wall. Heat is removed from the outer heat exchanger wall by a heat recovery medium. 3 figs., 3 tabs.

4203 Lasers

REFER ALSO TO CITATION(S) 12251

11558 (LA-UR—88-3436) Reflectance of aluminum reflectors in the extreme ultraviolet. Scott, M.L. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 7p. (CONF-880904—3). NTIS, PC A02/MF A01 - OSTI. Order Number DE89002126/JAW.

From 4. topical meeting on short wavelength coherent radiation: generation and applications; Cape Cod, MA, USA (26 Sep 1988).

We have investigated a new concept in retro-reflectors for use in the extreme ultraviolet, namely, uhv aluminum coated, multifacet, grazing-incidence mirrors. Our results indicate that this type of mirror, which utilizes total-external-reflectance, works very well in the wavelength range from 35 nm to 100 nm (89+-3% measured retroreflectance at 58.4 nm for a 9-facet mirror). However, the coated mirror surfaces must not be allowed to oxidize after deposition, which implies that the retro-reflector must be coated and used in situ or the oxide layer must be removed in a ultra-high vacuum (uhv) system. 3 refs., 3 figs.

11559 (LA-UR—88-3992) A multi-facet XUV aluminum mirror for the FEL. Scott, M.L. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 5p. (CONF-8810246—2). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89003599/JAW.

From Symposium on optical materials for high power lasers; Boulder, CO, USA (26 Oct 1988).

We have investigated a new concept in retro-reflectors for use in the extreme ultraviolet, namely, UHV aluminum coated, multi-facet, grazing-incidence mirrors. Our results indicate that this type of mirror, which utilizes total-external-reflectance, works very well in the wavelength range from 35 nm to 100 nm (89 +- 3% measured retroreflectance at 58.4 nm for a 9-facet mirror). However, the coated mirror surfaces must not be allowed to oxidize after deposition, which implies that the retro-reflector must be coated and used in situ or the oxide layer must be removed in an ultra-high vacuum (UHV) system. 3 refs., 3 figs.

11560 (UCRL—99058) Progress towards a 44-{angstrom} X-ray laser. MacGowan, B.J.; Bourgade, J.L.; Combis, P.; Keane, C.J.; London, R.A.; Louis-Jacquet, M.; Matthews, D.L.; Maxon, S.; Naccache, D.; Rosen, M.D. (Lawrence Livermore National Lab., CA (USA)). Nov 1988. Contract W-7405-ENG-48;AC03-76SF00098. 9p. (CONF-880904—5). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004807/JAW.

From 4. topical meeting on short wavelength coherent radiation: generation and applications; Cape Cod, MA, USA (26 Sep 1988).

Since 1984 when soft x-ray amplification was convincingly demonstrated at XUV wavelengths near 200 {angstrom}, much effort has gone into obtaining soft x-ray gain at shorter wavelengths. One motivation is the possibility of using a high brightness source of amplified spontaneous emission to perform holography of live biological specimens over short time scales. 33 refs., 4 figs., 3 tabs.

11561 (UCRL—100001) Ne-like ion x-ray laser experiments in plasmas produced by 0.53-μm and 0.35-μm laser light. Keane, C.J.; Bourgade, J.L.; Combis, P.; London, R.A.; Louis-Jacquet, M.; MacGowan, B.J.; Matthews, D.L.; Naccache, D.; Peyrusse, O.; Rosen, M.D. (Lawrence Livermore National Lab., CA (USA)). Nov 1988. Contract W-7405-ENG-48. 6p. (CONF-880904—7). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004827/JAW.

From 4. topical meeting on short wavelength coherent radiation: generation and applications; Cape Cod, MA, USA (26 Sep 1988).

Recent Ne-like ion x-ray laser experiments carried out at the Centre d'Etudes de Limeil-Valenton (CEL-V) with both 0.53-μm and 0.35-μm laser light will be described. This paper will concentrate primarily on the observation of amplification in Ne-like Sr (Z = 38) in plasmas produced by 0.53-μm laser light. Small signal gains of 4.4 cm/sup {minus}1/ and 4.0 cm/sup {minus}1/ have been measured for the Ne-like Sr J = 2--1 transitions at 164.1 and 166.5 {angstrom}, respectively. In addition, the effects of pumping the Ne-like Se laser with 0.35-μm light have been investigated. The resulting Se spectra do not differ significantly from those observed with 0.53-μm light. A brief summary of other experiments carried out at CEL-V will also be given. 18 refs., 5 figs., 1 tab.

11562 (UCRL—100109) The x-ray laser: Review of recent experimental results and of future prospects. Matthews, D.L.; Keane, C.J.; MacGowan, B.J.; Trebes, J. (Lawrence Livermore National Lab., CA (USA)). Oct 1988. Contract W-7405-ENG-48. 4p. (CONF-881056—9). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005096/JAW.

From 19. European conference on laser interaction with matter (ECLIM); Madrid, Spain (3 Oct 1988).

We report the status of x-ray laser development in terms of x-ray wavelengths and efficiencies achieved. We also will discuss the x-ray laser characteristics needed to develop x-ray holographic imaging of in vitro human cells as well as other interesting new applications. Finally, we will comment on the new schemes emerging which should lead to much shorter x-ray wavelengths, perhaps approaching 1 nm. 26 refs., 3 figs.

11563 On the buildup of laser oscillation from noise. Milonni, P.W. (Theoretical Division, Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *American Journal of Physics;* **57**: No. 2, 127-128(Feb 1989).

It is well known that laser oscillation is initiated by spontaneous radiation "noise." Evidence for this is often based on the complete theory of laser oscillation, including the quantization of the electromagnetic field. In this article, the buildup of laser oscillation from quantum noise is demonstrated using the most elementary classical equation describing the amplification of laser intensity.

11564 Efficiency optimization for free-electron laser oscillators. Serbeto, A.; Levush, B.; Antonsen T.M. Jr. (Laboratory for Plasma and Fusion Energy Studies, University of Maryland, College Park, Maryland 20742). *Physics of Fluids B: Plasma Physics;* **1**: No. 2, 435-439(Feb 1989).

Using a normalized set of nonlinear equations, which describe a free-electron laser (FEL) oscillator, the efficiency of energy extraction from the electron beam to the radiation can be optimized. The optimum values of this efficiency are presented for (a) an untapered and (b) a tapered wiggler FEL oscillator.

11565 Base line design for the Intense Microwave Prototype wiggler. Jong, R.A.; Throop, A.L.; Scharlemann, E.T. (Lawrence Livermore National Laboratory, University of California, Livermore, California 94550). *Review of Scientific Instruments;* **60**: No. 2, 186-197(Feb 1989).

We describe the base line design for the wiggler to be used in conjunction with the Experimental Test Accelerator-II (ETA-II) to produce high-power microwave radiation in the Intense Microwave Prototype (IMP) free-electron laser experiment. This design produces negligible noise growth for spontaneous noise sources as large as 20 dB above shot noise, and thus corrects the defects present in earlier iterations of the design, which resulted in diminished gain at the signal frequency because of space-charge effects as well as enhanced spontaneous noise growth at frequencies lower than the signal frequency. In addition, more realistic engineering design constraints on the waveguide size and the wiggler gap spacing have been set by the waveguide wall loading and the electron beam fill factor and have been incorporated in the final base line design. The design assumes that the ETA-II accelerator will supply an electron beam with an energy of 10 MeV, a current of 3 kA, and a brightness of 1.0×10^8 A/(m rad)^2. With this beam and 500 W of input power at a frequency of 250 GHz, the peak output TE_{01} power predicted by the simulation codes, for a rectangular waveguide of dimensions 3.5 x 3.0 cm^2, is in excess of 12 GW, corresponding to an extraction efficiency of 44%. The wiggler has an overall length of 5.5 m and a period of 10 cm. It consists of a 2-m untapered section at a magnetic field of about 4.3 kG followed by a

3.5-m tapered section with magnetic field ranging from a peak value of 4.5 kG to a minimum of 390 G. The growth of the beam linear fill factor to about 50% sets the lower limit of the magnetic field strength in the tapered wiggler region. A nonsteering, nondisplacing binomial winding pattern has been incorporated into the wiggler profile.

11566 **Experimental elimination of plasma effects in a gas-loaded, free-electron laser.** Reid, M.B.; Fisher, A.S.; Feinstein, J.; Ho, A.H.; O-dieresiszcan, M.; Dulman, H.D.; Lee, Y.J.; Pantell, R.H. (Department of Electrical Engineering, Stanford University, Stanford, California 94305). *Physical Review Letters;* 62: No. 3, 249-252(16 Jan 1989).

Saturated oscillation of a free-electron laser operating in the near infrared has been achieved with 200 Torr of H_2 gas introduced into the optical cavity. Plasma effects which limited output power in previous gas-loaded, free-electron laser experiments have been eliminated through the use of a small doping fraction of an electron-attachment gas. It is necessary to flow the gas mixture through the oscillator cavity to avoid depletion of the dopant through dissociation. Measured gain is consistent with theory, as is the observed wavelength tuning of 0.7 μm.

11567 **Transitions in Fe-, Co-, Cu-, and Zn-like ions of W and Re.** Seely, J.F.; Brown, C.M.; Behring, W.E. (E. O. Hulburt Center for Space Research, Naval Research Laboratory, Washington, D.C. 20375-5000). *Journal of the Optical Society of America B: Optical Physics;* 6: No. 1, 3-6(Jan 1989).

The spectra of highly ionized W and Re were observed by using laser-produced plasmas and a 3-m grazing-incidence spectrograph. Transitions in Fe- through Zn-like ions were identified. Wavelengths in the range 7—75 A were measured with an uncertainty of +- 0.015 A, and energy levels were derived from the measured wavelengths. The ionization limits of Cu-like W and Re were determined.

11568 **Fusion reactor pumped laser.** Jassby, D.L. US Patent Application 6-092,987. 4 Sep 1987. 30p. Contract AC02-76CH03073. DE89000179 NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE89000179/JAW.

A nuclear pumped laser capable of producing long pulses of very high power laser radiation is provided. A toroidal fusion reactor provides energetic neutrons which are slowed down by a moderator. The moderated neutrons are converted to energetic particles capable of pumping a lasing medium. The lasing medium is housed in an annular cell surrounding the reactor. The cell includes an annular reflecting mirror at the bottom and an annular output window at the top. A neutron reflector is disposed around the cell to reflect escaping neutrons back into the cell. The laser radiation from the annular window is focused onto a beam compactor which generates a single coherent output laser beam. 10 figs.

4204 Heat Transfer And Fluid Flow

REFER ALSO TO CITATION(S) 10755, 10961, 11549

11569 **(ENEA-RT-TERM—88-3) Influence of flow obstructions on flooding phenomena in vertical channels.** Celata, G.P.; Cumo, M.; Farello, G.E.; Setaro, T. (ENEA, Casaccia (Italy). Centro Ricerche Energia). (ENEA, Rome (Italy)). 1988. 24p. (CONF-8805226—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705247/JAW.

From European two-phase flow group meeting; Brussels, Belgium (30 May 1988).

Flooding phenomenon limits the stability of a liquid film falling downwards along the walls of a channel inside which an upwards gas flow takes place. As known, this entrainment effect can completely prevent the liquid fall from its natural flow. A local reduction of the flow channel cross section, due for instance to an obstruction, will affect the flooding parameters, depending on the position at which the obstruction is located and on the obstruction flow cross section. The present work deals with an air-water experiment carried out with a transparent circular duct test section, inside which it is possible to insert orifices having several diameters, to test the influence of the obstruction on flooding parameters. Predictions by the correlations available in literature are compared and a method to evaluate the influence of the obstruction is proposed.

11570 **(ENEA-RT-VEL—88-1) Turbulence modelling of axial flow through a wall subchannel of a smooth rod bundle.** Barbaro, M. (ENEA, Bologna (Italy)). (ENEA, Rome (Italy)). 1988. 28p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705249/JAW.

A finite difference method has been employed to predict the main features of fully developed turbulent flow through a wall subchannel of a smooth rod bundle. The study has been performed solving the time-averaged Navier-Stokes equations in general curvilinear orthogonal coordinates, with the eddy viscosity determined by the "k-ϵ" turbolence model. Comparisons between the computer predictions and the experimental data available in the literature for a pitch to diameter ratio of the rods equal to 1.07 are presented. The pedictions display a satisfactory agreement with the experimental results for some hydrodynamic quantities of engineering interest, e.g. the wall friction factor and the maximum to average fluid velocity ratio. However, the model underpredicts considerably the flow field in the narrow gaps between the rods, due to the assumption of eddy viscosity isotropy.

11571 **(KFK—4416) On the calculation of hydrostatic pressures with SIMMER-II and the problem of connected tubes.** Schmuck, P.; Kleinheins, S. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Neutronenphysik und Reaktortechnik; Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Projekt Schneller Brueter). Jul 1988. 32p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756387/JAW.

SIMMER simulations of flows in connected tubes exhibited non-physical movement of liquid under gravity. Analytical expressions are developed to evaluate the reasons for this effect and are used as a basis for proposals to keep the error small in SIMMER calculations. The effectiveness of the proposals is demonstrated by SIMMER code simulations of some numerical examples.

11572 **(KFK—4466) Measurement of the structure of turbulence in symmetric wall subchannels with P/D=1.148 and W/D=1.074.** Wu, S.R.; Rehme, K. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Neutronenphysik und Reaktortechnik). Sep 1988. 157p. NTIS (US Sales Only), PC A08/MF A01. Order Number DE88756392/JAW.

Measurements of the mean velocity, the wall shear stresses, and the turbulent Reynolds stresses were performed in two symmetrical wall subchannels of a rod bundle. The rod bundle of four parallel rods was arranged symmetrically in a rectangular channel with a pitch-to-diameter ratio of P/D=1.148 and a wall-to-diameter ratio of W/D=1.074. The Reynolds number of this investigation was Re=7.07x10/sup 4/. The experimental results show that the structure of turbulence in this rod bundle differs greatly from the structure in circular tubes. Especially in the narrow gaps between the rods and the channel walls there are increased levels of turbulent intensities in the axial and azimuthal directions and, hence, of the kinetic energy of turbulence. In contrast to a previous investigation in this geometry, however arranged asymmetrically in the rectangular channel, the momentum transport between the subchannels across the gap between the rods is negligible. The comparisons between experimental wall shear stress distributions and those computed by the VELASCO code shows strong deviations, especially in the gaps between the rods and channel walls.

11573 **(N—89-10560) Programming the Navier-Stokes computer: an abstract machine model and a visual editor. Final Interim Report No. 5.** Middleton, D.; Crockett, T.; Tomboulian, S. (National Aeronautics and Space Administration, Hampton, VA (USA). Langley Research Center). Aug 1988. 31p. (NASA-CR—181691; NAS—1.26:181691). NTIS, PC A03/MF A01.

The Navier-Stokes computer is a parallel computer designed to solve Computational Fluid Dynamics problems. Each processor contains several floating point units which can be configured under

program control to implement a vector pipeline with several inputs and outputs. Since the development of an effective compiler for this computer appears to be very difficult, machine level programming seems necessary and support tools for this process have been studied. These support tools are organized into a graphical program editor. A programming process is described by which appropriate computations may be efficiently implemented on the Navier-Stokes computer. The graphical editor would support this programming process, verifying various programmer choices for correctness and deducing values such as pipeline delays and network configurations. Step by step details are provided and demonstrated with two example programs.

11574 (N—89-11153) **Mixing and demixing processes in multiphase flows with application to propulsion systems.** Decker, R.; Schafer, C.F. (National Aeronautics and Space Administration, Huntsville, AL (USA). George C. Marshall Space Flight Center). Jul 1988. 191p. (NASA-CP—3006; M—591; NAS—1.55:3006; CONF-880250—). NTIS, PC A09/MF A01.

From Transport processes in dispersed two-phase flows with applications to propulsion systems; Huntsville, AL, USA (25 Feb 1988).

A workshop on transport processes in multiphase flow was held at the Marshall Space Flight Center on February 25 and 26, 1988. The program, abstracts and text of the presentations at this workshop are presented. The objective of the workshop was to enhance our understanding of mass, momentum, and energy transport processes in laminar and turbulent multiphase shear flows in combustion and propulsion environments.

11575 (N—89-11153, pp 33-53) **Turbulence modeling of gas-solid suspension flows.** Chen, C.P. Jul 1988. NTIS, PC A09/MF A01. (NASA-CP—3006; M—591; NAS—1.55:3006; CONF-880250—).

From Transport processes in dispersed two-phase flows with applications to propulsion systems; Huntsville, AL, USA (25 Feb 1988).

The purpose here is to discuss and review advances in two-phase turbulent modeling techniques and their applications in various gas-solid suspension flow situations. In addition to the turbulence closures, heat transfer effect, particle dispersion and wall effects are partially covered.

11576 (N—89-11153, pp 55-85) **Confined turbulent fluid-particle flow modeling using multiple-realization particle trajectory schemes.** Adeniji-Fashola, A.A. Jul 1988. NTIS, PC A09/MF A01. (NASA-CP—3006; M—591; NAS—1.55:3006; CONF-880250—).

From Transport processes in dispersed two-phase flows with applications to propulsion systems; Huntsville, AL, USA (25 Feb 1988).

A multiple-realization particle trajectory scheme has been developed and applied to the numerical prediction of confined turbulent fluid-particle flows. The example flows investigated include the vertical pipe upflow experimental data of Tsuji et al. and the experimental data of Leavitt for a coaxial jet flow, comprising a particle-laden central jet and a clean annular jet, into a large recirculation chamber. The results obtained from the numerical scheme agree well with the experimental data, lending confidence to the modeling approach. The multiple-realization particle trajectory turbulent flow modeling scheme is believed to be a more elegant and accurate approach to the extension of single-particle hydrodynamics to dilute multi-particle systems than the more commonly employed two-fluid modeling approach. It is also better able to incorporate additional force items such as lift, virtual mass and Bassett history terms directly into the particle equation of motion as appropriate. This makes it a suitable candidate for particle migration studies and an extension to situations involving liquid particulate phases with possible propulsion applications, such as in spray combustion, follows naturally.

11577 (N—89-11153, pp 161-179) **Turbulent heat flux in low Mach number flows with large density variations.** Orourke, P.J.; Collins, L.R. Jul 1988. NTIS, PC A09/MF A01. (NASA-CP—3006; M—591; NAS—1.55:3006; CONF-880250—).

From Transport processes in dispersed two-phase flows with applications to propulsion systems; Huntsville, AL, USA (25 Feb 1988).

A transport equation has been derived which is the difference between the volume- and mass-averaged velocities and is simply related to the turbulent heat flux phi sup h. Using this equation and an assumption analogous to the drift flux approximation of two-phase flow modeling, an algebraic closure relation for phi sup h that exibits fluxes due to directed transport proportional to -del anti p and due to gradient transport proportional to -del tau has been obtained.

11578 (PB—89-122402/XAB) **Room-temperature thermal-resistance measurements of new and existing materials for shipboard air-duct systems.** Zarr, R.R.; Somers, T.A. (National Inst. of Standards and Technology, Gaithersburg, MD (USA)). Oct 1988. 16p. (NISTIR—88/3861). NTIS, PC A03/MF A01.

Thermal resistance measurements of conventional and composite-material insulation for shipboard air duct systems are described. Conventional shipboard air ducts are constructed of metal walls insulated externally with fibrous-glass board. Composite materials are being considered as replacements for these duct walls. Thermal measurements were conducted using the National Bureau of Standards 1-meter Guarded Hot Plate at a mean temperature of 23.9°C (75°F). Measurements of the fibrous-glass board specimens were within 3% of certified values of NBS SRM 1450a, fibrous-glass board. Measurements of two aramid-fiber honeycomb specimens were approximately one-half the thermal resistance of the fibrous-glass board specimens.

11579 (PNL-SA—15524) **A review of second law techniques applicable to basic thermal science research.** Drost, M.K.; Zamorski, J.R. (Pacific Northwest Lab., Richland, WA (USA)). Nov 1988. Contract AC06-76RL01830. 13p. (CONF-8809201—1). NTIS, PC A03/MF A01 - OSTI. Order Number DE89004356/JAW.

From American Institute of Mechanical Engineers meeting; Chicago, IL, USA (25 Sep 1988).

This paper reports the results of a review of second law analysis techniques which can contribute to basic research in the thermal sciences. The review demonstrated that second law analysis has a role in basic thermal science research. Unlike traditional techniques, second law analysis accurately identifies the sources and location of thermodynamic losses. This allows the development of innovative solutions to thermal science problems by directing research to the key technical issues. Two classes of second law techniques were identified as being particularly useful. First, system and component investigations can provide information of the source and nature of irreversibilities on a macroscopic scale. This information will help to identify new research topics and will support the evaluation of current research efforts. Second, the differential approach can provide information on the causes and spatial and temporal distribution of local irreversibilities. This information enhances the understanding of fluid mechanics, thermodynamics, and heat and mass transfer, and may suggest innovative methods for reducing irreversibilities. 6 refs.

11580 (UCRL—98686) **Application of a two-equation turbulence mix model.** Crowley, W.P. (Lawrence Livermore National Lab., CA (USA)). 1988. Contract W-7405-ENG-48. 19p. (CONF-8810234—2). NTIS, PC A03/MF A01 - OSTI. Order Number DE89004812/JAW.

From Workshop on the physics of compressible turbulent mixing; Princeton, NJ, USA (24 Oct 1988).

A mass averaged k-ϵ model was derived by Leith using a moment expansion and appropriate closure models. Moving the mesh with the mass averaged velocity results in a Lagrangian model with constant mass in each zone. In this paper Leith's model is transformed into an "Almost Lagrangian" model by taking the mesh velocity to be the ensemble averaged fluid velocity. Here the mass in each zone may change with time. The resulting 1-D model is used to simulate the Smits and Muck supersonic wind tunnel experiment in which pre- existing turbulence is amplified by a shock wave. From the model results we deduce a simplified k-ϵ model that is applicable to the Smits and Muck (S&M) experiment. In the

analytic solution for the simplified model we find the shock thickness to be increased by a factor of 10^5; behind the shock the turbulent energy decays at t/sup {minus}1/. 6 refs., 9 figs.

4205 Materials Testing

REFER ALSO TO CITATION(S) 10738, 11264, 11327, 11389, 11546, 11550, 11578

11581 (CEA-CONF—9574) Realizations and prospects of eddy current testing. Methods and materials. Stossel, A. (CEA Centre d'Etudes Nucleaires de Cadarache, 13 - Saint-Paul-les-Durance (France). Inst. de Recherche Technologique et de Developpement Industriel (IRDI)). 1988. 13p. (In French). (CONF-8804225—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756225/JAW.

From APEND national meeting on realization and prospects in NDT; Aix-en-Provence, France (27 Apr 1988).

State of the art in nondestructive testing by eddy currents is presented in this paper: equipment, circuits, technique. Applications are evoked by giving representative realizations which are not limited to aeronautics or nuclear industry.

11582 (EGG-M—26287) NDE methods for high-temperature materials and environments. Barna, B.A.; Allemeier, R.T.; Carlson, N.M.; Johnson, J.A.; Rodriguez, J.G.; Shull, C.L.; Tow, D.M. (EG and G Idaho, Inc., Idaho Falls (USA)). 1988. Contract AC07-76ID01570. 5p. (CONF-880691—3). NTIS, PC A02 - OSTI. Order Number DE89005195/JAW.

From 6. international congress on experimental mechanics; Portland, OR, USA (5 Jun 1988).

The application of acousto-optic or optic sensing techniques to three high-temperature materials or processes is described. Noncontacting, laser-based sensors are used to image high-luminosity processes, generate ultrasound in molten weld pools, and detect surface dynamics for vibrational analysis. The description of these distinct research efforts gives an overview of one potential approach for developing new capabilities for high-temperature environments. 3 refs., 5 figs.

11583 (LA-UR—88-3080) Force state mapping using experimental data. Hunter, N.F. Jr.; Paez, T.; Gregory, D.L. (Los Alamos National Lab., NM (USA)). 1989. Contract W-7405-ENG-36. 19p. (CONF-890225—1). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89000351/JAW.

From International modal analysis conference; Las Vegas, NV, USA (3 Feb 1989).

Techniques for the characterization and analysis of linear systems are well developed. Many techniques applicable to linear systems have limited applicability for nonlinear systems. In dealing with nonlinear systems, numerous new techniques are under development. New methods which are specifically tailored for nonlinear systems include force state mapping, difference equation techniques, and higher order frequency response functions. The force state mapping technique was introduced by Tomlinson and Worden. Their work is in turn based on a system identification procedure introduced by Masri and Caughey. In this paper we apply the technique to a linear system and to several types of nonlinear second order systems. In particular, we emphasize application of the technique to motion across a nonlinear joint or interface. For second order systems, this approach is quite straightforward, and the major problem is the development and application of techniques for dealing with noisy data. Extension of the technique to multi-degree-of-freedom systems requires explicit computation of the mass associated with each measurement location. Possible techniques for determining the magnitude of these mass terms are introduced as extensions of the technique for multi-degree-of-freedom systems. Either local or global estimation schemes may be used to determine the shape of the fitted surfaces. We emphasize global parameter estimation techniques for surfaces and apply these global estimation techniques in the time and frequency domains. 6 refs., 6 figs.

11584 (PB—89-127286/XAB) Room-temperature thermal conductivity of fumed-silica insulation for a standard reference material. Zarr, R.R.; Somers, T.A.; Ebberts, D.F. (National Inst. of Standards and Technology (NEL), Gaithersburg, MD (USA). Heat Transfer Group). Oct 1988. 31p. (NISTIR—88/3847). NTIS, PC A03/MF A01.

Thermal conductivity of fumed-silica insulation board was measured using the National Bureau of Standards 1-meter Guarded Hot Plate. Measurements were conducted for the following range of parameters: bulk density, 304.5 to 325.4 kg/cu m; mean temperature, 283.1 to 311.0 K; and barometric pressure, 97.51 to 103.40 kPa. The effect of moisture content on room-temperature measurements was minimized by prior conditioning of the specimen at 100°C for 24 hours. Seventy-five samples (600 by 600 by 25.4 mm) were transferred to the Office of Standard Reference Materials in Gaithersburg, Maryland, USA. The material is offered as a Standard Reference Material having a low thermal conductivity at room temperature.

11585 (UCRL—100056) Mix experiments with the NOVA laser. Rupert, V.C.; Kilkenny, J.D.; Skokowski, P.G. (Lawrence Livermore National Lab., CA (USA)). Oct 1988. Contract W-7405-ENG-48. 10p. (CONF-8810234—3). NTIS, PC A02/MF A01 - OSTI. Order Number DE89004775/JAW.

From Workshop on the physics of compressible turbulent mixing; Princeton, NJ, USA (24 Oct 1988).

The NOVA mix experiments are designed to study mix between two dissimilar materials subjected to strong (M{approximately}50) shocks and variable accelerations in a direction normal to their common boundary. The main purpose of the experiments is to provide a data base with which predictive models can be compared and normalized. Together with shock tube experiments, which explore a different regime, the current NOVA tests investigate the shock induced source terms in our model and the evolution of both Rayleigh-Taylor stable and unstable interfaces. 3 refs., 9 figs.

4208 Electronic Circuits And Devices

REFER ALSO TO CITATION(S) 11390, 11402, 11413, 11698

11586 (SAND—87-2524C) A comparison of the step coverage of aluminum coatings produced by two sputter magnetron systems and a dual beam ion system. Panitz, J.K.G.; Draper, B.L.; Curlee, R.M. (Sandia National Labs., Albuquerque, NM (USA)). 1987. Contract AC04-76DP00789. 17p. (CONF-880488—6). NTIS, PC A03/MF A01 - OSTI. Order Number DE89003400/JAW.

From 15. international conference on metallurgical coatings; San Diego, CA, United States (11 Apr 1988).

We have metallized 0.6 μm deep features on silicon integrated circuits using three different deposition systems. Step coverage problems, which are in part associated with substrate mounting geometry, and in part associated with the geometry of the surface features, have been encountered. These problems can be mitigated by changing the substrate mounting geometry, and/or by bombarding the coatings with argon during deposition. The effects of changing the energy and the current density of the bombarding argon flux were investigated using a dual beam ion system. Our results show that the best coatings from the standpoint of step coverage and electrical resistivity occur for extremely low energy (70 eV) argon bombardment. Porous, irregular coatings with high resistivities result from argon bombardment at higher energies and higher current densities. These results are comparable to the results achieved using a DC magnetron system, where a substrate bias on the order of {minus}200 to {minus}250 V is necessary to obtain a similar degree of coating planarization. 10 refs., 4 figs.

11587 (SAND—88-7106C) Photocurrent modeling of modern microcircuit PN junctions. Enlow, E.E.; Alexander, D.R. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 37p. (CONF-880730—5-FP). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE88012860/JAW.

From 25. annual conference on nuclear and space radiation effects; Portland, OR, USA (12 Jul 1988).

Mathematical models have been developed for time dependent photocurrent prediction in modern microcircuit PN junctions. The enhanced photocurrent model addresses deficiencies in the Wirth-Rogers photocurrent model for the application to modern microcircuits. The enhanced model incorporates high injection effects on excess minority carrier lifetime and an electric field in the quasi-neutral regions. Both of these effects increase photocurrent production especially in high resistivity material. The enhanced model also includes the effect of the proximity of an ohmic contact or high/low junction. The addition of these variables adds complexity to the enhanced photocurrent model, which was constructed for use in computer simulation codes for analyzing dose rate effects on microcircuits. The enhanced photocurrent model has been successfully implemented in SPICE 2G. 4 refs., 7 figs., 1 tab.

11588 **(STU—84-3623) Frequency changer under 100 kW for energy conservation.** Faelt, J.; Karlsson, R.; Thorborg, K. (Chalmers Univ. of Tech., Goeteborg (SE). School of electrical and computer engineering). (Swedish National Board for Technical Development, Stockholm). Jul 1987. 83p. (In Swedish). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88755900/JAW.

The project aims at developing new or improved frequency changers under 100 kW, that could be cheap enough to be used at many new or existing electric motor installations. The electric energy conservation potential is very large. (G.B.).

11589 **(UCRL—21133) Explosively driven 1 MV output air-core pulse transformer design: Final report.** Champney, P.D'A.; Eichenberger, C. (Lawrence Livermore National Lab., CA (USA); Pulse Sciences, Inc., San Leandro, CA (USA)). Sep 1988. Contract W-7405-ENG-48. 59p. (PSI-FR—3358-01). NTIS, PC A04/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005552/JAW.

This report presents the results of a pulse transformer design program conducted by Pulse Sciences Inc., (PSI) for the Lawrence Livermore National Laboratory (LLNL). The principle program objective was the development of a 1 MV output air-core pulse transformer design compatible with an LLNL explosive driver concept. 34 figs.

11590 **(UCRL—21138) High current, high coulomb ignitrons: Final report, May 20, 1988--September 30, 1988.** Giesselmann, M.; Kristiansen, M. (Lawrence Livermore National Lab., CA (USA); Texas Tech Univ., Lubbock (USA). Pulsed Power Lab.). 1988. Contract W-7405-ENG-48. 29p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005547/JAW.

Texas Tech University is currently conducting research to develop high power ignitrons. The new ignitrons should be able to handle currents up to 1000 kA with a charge transfer of more than 500 C's per shot. Other requirements are a reasonable lifetime of 500--1000 shots and a low forward voltage drop. The project is carried out jointly between manufacturers, (Richardson Electronics/US and EEV/UK), Lawrence Livermore National Laboratory (LLNL) and Texas Tech University (TTU). Two Workshops have been held at TTU and LLNL to coordinate the work and address the research areas. Since the beginning of the ignitron work at TTU, a capacitor bank, a charging power supply, several test stands for critically damped and crowbarred operations, two high speed cameras, a Mach-Zehnder interferometer and electrical diagnostics equipment were set up and tested. High power voltage and current measurements, as well as high speed photography of the discharge plasma, have been performed. The effects of axial magnetic fields on the discharge plasma and the holdoff voltage have also been studied. 3 refs., 12 figs., 2 tabs.

11591 **(UCRL—21140) Calculation of mutual self inductance and coupling coefficient for closely spaced loops: Final report for the period April 15, 1987 to April 15, 1988.** Carpenter, K.H. (Lawrence Livermore National Lab., CA (USA); Kansas State Univ., Manhattan (USA)). 20 Jun 1988. Contract W-7405-ENG-48. 99p. NTIS, PC A06/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005546/JAW.

The magnetic coupling of closely spaced, flat loops has been studied, assuming both coupling in air and coupling in the presence of ferrite cores. The equivalent circuits for such coupled loops have been derived, and the effect of resistance in the loops on measurements of coupling evaluated. For loops typically used, conductor resistance was found to have no significant effect on measurements. Series expansions for vector potential and mutual inductance have been derived for circular flat loops, and these expansions have been used to write a computer code, COUPM2IN, which simulates the magnetic coupling accurately enough to be used to aid air cored transformer design. With ferrite cores present the magnetizing current is a much smaller fraction of transformer current than with air cored design. Thus even though the models determined for the ferrite cored inductors only approximately simulate the saturation of the ferrite and the delay of the rotation of the magnetic domains, these models can be used to aid ferrite cored transformer design. The computer codes for both the air cored and ferrite cored cases are listed in appendices. It is recommended that follow up work be undertaken to refine the ferrite core modeling and to produce more robust computer programs for transformer designers. 21 refs., 19 figs., 2 tabs.

11592 **(UCRL—97840) Modeling the propagation of long intense microwave pulses in mixtures of air and SF_6.** Khanaka, G.H.; Yee, J.H.; Mayhall, D.J. (Lawrence Livermore National Lab., CA (USA)). 14 Oct 1988. Contract W-7405-ENG-48. 13p. (CONF-8805132—12). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004787/JAW.

From 4. national high power microwave conference; Monterey, CA, USA (9 May 1988).

We have used a set of self-consistent equations---Maxwell's equations and the electron fluid transport equations---to study the interaction of long intense microwave pulses with gases. In this interaction, the final shape of the transmitted pulse at breakdown is independent of the pulse length. We found that the threshold for breakdown is a factor of 7 higher in SF_6 than in air. This difference we attribute to the fact that SF_6 is an insulator. When SF_6 was mixed with air, the breakdown threshold increased with the increase in the percentage of SF_6. Introducing 5--10% of SF_6 in air increased the breakdown threshold by a factor of 3--4. The electron density and conductivity and the plasma frequency increased as the pulse intensity increased. The growth rates of the electron density and conductivity were much higher in air than in SF_6. 3 refs., 7 figs., 2 tabs.

11593 **(UCRL—100104) Analog high-bandwidth single-shot data link using integrated optical modulators and a high fidelity optical streak camera.** Lowry, M.; Lancaster, G.; Peterson, R.T.; Kidd, B.; Nelson, D.; Roeske, F. (Lawrence Livermore National Lab., CA (USA)). Sep 1988. Contract W-7405-ENG-48. 6p. (CONF-8809105—12). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005353/JAW.

From SPIE O-E Lase: international symposium and exhibition on fiber optics, optoelectronics and laser applications; Boston, MA, USA (6 Sep 1988).

We present preliminary data on the fidelity of an analog optical data link operating at 830 nm. This data link encodes an electrical signal on an optical carrier by the action of a commercially available integrated-optic modulator, a 2x2 switch, from Crystal Technology, Inc. (CTI). An optical streak camera is used to record the modulated optical carrier. With this single-shot system a precision of 2--5% is realized. The dynamic range of the system is approximately 30 dB (power). The present system bandwidth is limited to 3 Ghz by the CTI modulator. New modulator designs using travelling wave structures will soon extend the system bandwidth to around 10 Ghz. We discuss the potential for development of a high-fidelity multichannel analog link based upon this technology and the potential impact on instrumentation for the measurement of ultra-fast single-transient phenomena. 5 refs., 10 figs.

11594 **Optoelectronic materials, devices, packaging, and interconnects; Proceedings of the Meeting, San Diego, CA, Aug. 19-21, 1987.** Batchman, T.E.; Carson, R.F.; Gallawa, R.L.; Wojtunik, H.J. Bellingham, WA; Society of Photo-Optical Instrumentation Engineers (1988). 387p. (CONF-8708229—).

From Optoelectronic materials, devices, packaging, and interconnects; San Diego, CA, USA (19 Aug 1987).

Recent advances in optoelectronic materials and their applications are considered in reviews and reports. Topics addressed include sensors and environmental effects; sources and detectors; semiconductor optoelectronic materials, devices, and structures; nonlinear guided-wave optics and bistability; fiber coupling and packaging; and optoelectronic and IC interconnects. Particular attention is given to the response of integrated optics to nuclear irradiation, ultrafast photoconductor radiation detectors, the concentration-dependent Ti center and the ordinary optical index of LiNbO3, ion-exchange fabrication of REE-doped waveguides, spin-polarization studies of Heusler alloys, self-sustained psec pulse generation from laser diodes, photorefractive effects in GaAs, MQW tunneling computations for asymmetric superlattices, multiple-fiber interconnects using Si V-grooves, and plasma-etched polymer waveguides for intrachip optical interconnects.

4210 Combustion Systems

REFER ALSO TO CITATION(S) 10659, 10660, 10673, 10675, 10676, 10677, 11197

11595 **(DOE/ID/12597—3) Oxygen enriched combustion system performance study: Volume 2, Market assessment: Phase 1, Final report.** Kobayashi, H. (Union Carbide Corp., Tarrytown, NY (USA). Linde Div.). Sep 1988. Contract AC07-85ID12597. 63p. NTIS, PC A04/MF A01 - OSTI. Order Number DE89004061/JAW.

The technical and economic feasibility of oxygen enriched combustion (OEC) was assessed for twenty-one different types of high temperature industrial furnaces in nine industries. Based on the relative energy savings with OEC, economics and overall consumption of energy, steel heating, glass and aluminum melting furnaces were shown to offer the greatest potential to achieve energy savings by implementing OEC. Detailed analyses for energy savings and economics were conducted for these furnaces. 21 refs., 22 tabs.

11596 **(KTM/E-D—157) Instructions for maintenance and optimal use of a heavy fuel oil plant 0.5-2.0 MW.** (Kauppa-ja Teollisuusministerio, Helsinki (Finland). Energiaosasto). Apr 1988. 84p. (In Finnish). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88755777/JAW.

The research included a theoretical and practical study on the efficiency, design and heat distribution systems of existing heavy fuel oil plants in the capacity range 0.5-2.0 MW. A detailed series of field measurements were carried out in a number of different buildings. From the results were determined the actual overall efficiency and required boiler capacity in different weather conditions and a connection between the boiler capacity output and efficiency was found. Also the importance of the factors that influence in the boiler efficiency was dealt with. The main losses of a boiler plant are the flue gas losses and the heat losses through oil heating, hot water boiler tanks and district heating network. Regular maintenance and optimal use of the plant are the most important factors in the improvement of the overall boiler efficiency. The design principles of existing boiler plants do not correspond to the actual operation conditions and heat demand. The main aspects are the overdimensioning of boilers and burners and the lack of a possibility of sequencing the units. The main conclusions of the research are presented in a datapackage for boiler plant operators. The instructions deal with plant operation, optimal use, necessary measurements, consumption monitoring, etc. from the operators point of view.

11597 **(NP—9770192) Effects of heat storage in, and heat emissions from the refractory lining of the ladle on the casting temperature in intermittent casting regimes.** Huenlich, T. (Technische Univ. Clausthal, Clausthal-Zellerfeld (Germany, F.R.). Inst. fuer Energieverfahrenstechnik). Feb 1983. 53p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE89770192/JAW.

The transient temperature distribution in the ladle lining as well as the cooling down of the molten metal from tapping to pouring is determined by means of a numeric computer program. Furthermore there is a calculation of the cooling-off of the empty ladle up to the next filling process. For this purpose measuring results are given for cylinder ladles and drum ladles of different size, different lining thicknesses, lining structure and varied operation modes in the form of temperature, time and quantity variations of the molten metal and casting time. Besides the derivation of a numeric calculation method, the computer program is described and the results of 14 tests are presented and evaluated.

11598 **(PB—89-120869/XAB) Overview of EPA's (Environmental Protection Agency's) program for retrofit sorbent-injection technologies.** Stern, R.D. (Environmental Protection Agency, Research Triangle Park, NC (USA). Air and Energy Engineering Research Lab.). Nov 1988. 24p. (EPA—600/D-88/232). NTIS, PC A03/MF A01.

An overview is given of EPA's research program to develop improved control technologies for emissions of sulfur dioxide (SO_2) and nitrogen oxides (NOx) from the combustion of fossil fuels. Analysis indicates that low-capital-cost technology for retrofit to existing boilers would provide flexibility in control strategy even at moderate (e.g., 50%) SO_2 removal rates. EPA is evaluating the Limestone Injection Multistage Burner (LIMB), which combines sorbent injection for SO_2 control with the use of low-NOx burners. EPA also is evaluating E-SOx and ADVACATE (ADVAnced SilCATE) technologies. E-SOx combines advanced electrostatic precipitator (ESP) technology and spray-dryer technology to remove particulate matter and SO_2 in the same physical equipment; the ADVACATE process uses in-duct injection of a highly reactive calcium sorbent for SO_2 control. The process may be used alone or in combination with LIMB to enhance performance. EPA's program for research and development, field evaluation, and demonstration of LIMB, E-SOx, and ADVACATE technologies is described.

11599 **(BG-Trans—15098) Electrical equipment for furnaces, fuel burning systems.** (DIN Deutsches Inst. fuer Normung e.V., Berlin (Germany, F.R.). Normenausschuss Kerntechnik). May 1988. Translation of German Standard DIN VDE 0116. 61p. NTIS (US Sales Only), PC A04/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004476/JAW.

This standard applies to the electrical equipment of furnaces which are operated with solid, liquid or gaseous fuels, and which are used in the following installations, for example: hot water generators; steam boilers (steam and hot water generators) within the meaning of the Regulation for Steam Boilers; hot air generators; hot gas generators; heat transfer systems; and combustion chambers of stationary turbines.

4230 Marine Engineering

11600 (ACUNS—88, pp 220-223) **Engineered materials for the Canadian Arctic offshore.** Young, S.B. (Univ. of Alberta, Edmonton). 1988. Association of Canadian Universities for Northern Studies, 130 Albert Street, Ottawa, Ont., Canada K1P 5G4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN. (CONF-8511343—; MICROLOG—88-02606).

From National student conference on northern studies; Ottawa, Canada (18 Nov 1985).

Expanding arctic frontier development associated with hydrocarbon exploration in recent years has resulted in new and unique materials engineering challenges. The Canadian arctic offshore poses some of the most severe environmental conditions in

the world: a minimum design temperature of -50/sup 0/C, massive ice loads and ice abrasion, and corrosive oxygen-rich cold seawater. Ice-breaking vessels and artificial islands or caissons exposed to these conditions have been constructed of specially developed steels. However, research and development continues in search of improved materials for greater versatility. Additionally, as arctic offshore experience has increased, it has been necessary to overcome unexpected problems resulting from the use of these new materials in the frontier environment. Materials engineers and metallurgists have connected specifically on maintaining steel toughness at low temperatures and overcoming unique corrosive problems resulting from the corrosive seawater combined with severe ice abrasion. Particular attention has been necessary in the development of welding procedures and welding materials designed to maintain weldment toughness. Also, due to the variable and often susceptible metallurgy of weldments, preferential corrosion evaluation and prevention problems have been, and are being overcome. The Canadian materials industry has responded, and is continuing, with research and development of materials for the arctic offshore. 9 refs.

11601 (ACUNS—88, pp 144-157) **The conceptual development of a new form of upward-acting icebreaker bow.** Paterson, B. (Memorial Univ. of Newfoundland, St. John's). 1988. Association of Canadian Universities for Northern Studies, 130 Albert Street, Ottawa, Ont., Canada K1P 5G4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN. (CONF-8511343—; MICROLOG—88-02606).

From National student conference on northern studies; Ottawa, Canada (18 Nov 1985).

A new form of upward-acting icebreaker bow has been developed that employs a shearing action which reduces resistance to ice. In the context of the broader design problem, the upward-acting icebreaking concept offers significant advantages because the broken ice moves along the hull above the waterline. Drillships, dredges, and floating production platforms could have their operating season expanded by adopting the concept. Safety and reliability would be enhanced by reducing the frequency of ice impact with hull appendages. While minimizing ice resistance is an important factor, the objective was to produce an upward acting bow with resistance comparable to a downward-acting bow, because of its important operational advantages. The design process began with a review of recent icebreaking innovations, past upward-acting bow designs, and available icebreaking analyses. The oil/bulk ore carrier Arctic, in level ice conditions, was used as a test case. Five configurations were tested in a small-scale refrigerated towing tank, using a recently developed model ice. These tests demonstrated the feasibility of the concept. Each towing trial was videotaped, and following a series of over 100 tests a configuration was selected for comparative resistance trials against a model equipped with a conventional icebreaker bow, at a scale of 1:30. 30 refs., 10 figs., 1 tab.

11602 (CONF-8710434—) **Marine raw materials exploitation and offshore engineering. Proceedings.** (Technische Univ. Berlin (Germany, F.R.)). 1987. 410p. (In German). NTIS (US Sales Only), PC A18. Order Number DE89770204/JAW.

From 10. advanced seminar on marine technology; Berlin, F.R. Germany (22 Oct 1987).

16 papers deal with a number of special fields of marine mineral resources exploitation and offshore engineering, marine constructions, inclusive. Reference is made to the latest exploration results as well as to dredge developments for offshore and deep-sea uses. Marine constructions are dealt with placing emphasis on stability and strength analyses. Access is given to interesting alternatives to the development of fields for different depths in moderate and rough seas.

11603 (DTH-ABK-I—86) **Fatigue tests on welded materials.** Magnusson, G.; Gravesen, S. (Danmarks Tekniske Hoejskole, Lyngby. Afdelingen for Baerende Konstruktioner). 1988. 25p. (In Danish). Available on loan from Risoe Library, DK-4000 Roskilde.

Using a 100 kN servo-controlled testing machine fatigue tests were performed on plates made of construction steel 52-3 (DIN 17100) that had been V welded (50 deg. C edge, 1.5mm rod) using CO2-welding with OK Autorod 12.51. The results of the seventeen tests are shown in the tables which are found in the appendix. (AB).

11604 (GKSS—88/E/28) **Welding pollution within the atmosphere of an underwater simulator.** Boie, H.; Schmidt, K.; Schnegelsberg, W. (GKSS-Forschungszentrum Geesthacht G.m.b.H., Geesthacht-Tesperhude (Germany, F.R.)). 1988. 7p. (CONF-880597—). GKSS-Forschungszentrum Geesthacht G.m.b.H., Geesthacht-Tesperhude (Germany, F.R.).

From Offshore technology conference; Houston, TX, USA (2 May 1988).

The paper reports on the measurements of carbon-monoxide and -dioxide distribution in the chamber/habitat atmosphere of an underwater simulator to determine knowledge about the real distribution of gaseous contaminants in detail during hyperbaric welding. Founded on appropriate exhaust conditions and an effective welding gas absorbing system the level of contaminants in the direct vicinity of the welding arc was proved below threshold limit values. A modified breathing protection equipment for the diver-welder with free flow light respiratory masks and gas supply via the welding gas absorber was tested successfully.

11605 (GKSS—88/E/29) **Considerations on welding procedures for hyperbaric FCAW down to 450 msw.** Szelagowski, P.; Santos, J.F. dos; Loebel, P.; Schafstall, H.G. (GKSS-Forschungszentrum Geesthacht G.m.b.H., Geesthacht-Tesperhude (Germany, F.R.)). 1988. 10p. (CONF-880597—). GKSS-Forschungszentrum Geesthacht G.m.b.H., Geesthacht-Tesperhude (Germany, F.R.).

From Offshore technology conference; Houston, TX, USA (2 May 1988).

This report presents the results from manual and robotic dry hyperbaric FCAW down to 450 msw. The influences of welding parameters, technique and consumables on overall weldment quality have been investigated. Based on the obtained results, which comply with BS 4515-84 and API 1104-83, a preliminary definition of welding procedures using the studied consumables, can be made.

11606 (NEI-NO—55) **Subsea solutions - Skuld/Superskuld modular concept.** Freudenreich, M. (Elf Aquitaine Norge A/S, Stavanger). (Norsk Petroleumsforening, Oslo). 1985. 16p. (In Norwegian). (CONF-8511344—1). NTIS (US Sales Only), PC A03. Order Number DE88755824/JAW.

From New development solutions on the Norwegian continental shelf in the next 10 to 15 years - consequences/possibilities for the Norwegian offshore industry; Trondheim, Norway (25 Nov 1985).

The report concerns the future development of the Norwegian continental shelf with respect to the new types of facilities and systems designed for deep water conditions. The Skuld and Superskuld concepts are presented, and consist of a modular underwater structure designed as an arrangement for the remote control of production systems. A specially designed floating vessel is used for the unmanned connection and disconnection procedures of the modules. 8 figures.

11607 (NEI-NO—56) **Buoyant concrete structures.** Nygaard, C.; Eie, R. (Norwegian Contractors, Stabekk (Norway)). (Norsk Petroleumsforening, Oslo). 1985. 31p. (In English). (CONF-8511344—2). NTIS (US Sales Only), PC A03. Order Number DE88755825/JAW.

From New development solutions on the Norwegian continental shelf in the next 10 to 15 years - consequences/possibilities for the Norwegian offshore industry; Trondheim, Norway (25 Nov 1985).

The report concerns the future development of the Norwegian continental shelf with respect to the new types of facilities and systems designed for deep water conditions. The design of the various structural parts of concrete floaters such as the topside- and riser arrangements, anchoring system, mechanical outfitting, oil offloading, and platform construction are discussed and presented. 16 drawings, 4 tables.

11608 **(NEI-NO—57) Floating production vessels in steel.** Leffler, J. (Goetaverken Arendal AB, Goeteborg (Sweden).). (Norsk Petroleumsforening, Oslo). 1985. 16p. (CONF-8511344—3). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755826/JAW.

From New development solutions on the Norwegian continental shelf in the next 10 to 15 years - consequences/possibilities for the Norwegian offshore industry; Trondheim, Norway (25 Nov 1985).

The report concerns the future development of the Norwegian continental shelf with respect to the new types of facilities and systems designed for deep water conditions. The floating production systems and vessels made of steel are discussed, and some thoughts on where to spend the research and development efforts to further advance the system state of the art are given. 7 drawings.

11609 **(NEI-NO—58) Non-platform solutions.** Oeverli, J.M. (Norske Stats Oljeselskap A/S, Stavanger (Norway)). (Norsk Petroleumsforening, Oslo). 1985. 22p. (In Norwegian). (CONF-8511344—4). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755827/JAW.

From New development solutions on the Norwegian continental shelf in the next 10 to 15 years - consequences/possibilities for the Norwegian offshore industry; Trondheim, Norway (25 Nov 1985).

The report concerns the future development of the Norwegian Continental shelf with respect to the new types of facilities and systems designed for deep water conditions. The various systems of deep water production and maintenance together with the evaluation of the multiphase transport systems are discussed and presented. 14 figures.

11610 **(SI-R—870115-1) Systems for the control and monitoring of underwater-completed production wells.** Carlsson, B.; Barstad, J.; Boerdalen, K. (Senter for Industriforskning, Oslo (Norway)). Dec 1987. 23p. (In Norwegian). NTIS (US Sales Only), PC A03. Order Number DE88755851/JAW.

The report discusses the need for the improved design of electric underwater systems to be used for the control and monitoring of offshore production wells. A concept is presented discussing the high-level quality demands of the systems designed for the second generation underwater installations. 3 figures.

11611 **(STF—67A88015) Evaluation of underwater-installed screw pumps for the pressure increase of unprocessed well flow.** Christiansen, B.; Nygaard, R. (Selskapet for Industriell og Teknisk Forskning, Trondheim (Norway)). Apr 1988. 273p. (In Norwegian). NTIS (US Sales Only), PC A12/MF A01. Order Number DE88755897/JAW.

The report evaluates the use of screw pumps in underwater installations for the pressure increase of unprocessed well flow. The evaluation of the mechanical- and hydraulic characteristics of the pump principles are the main limited to the screw pumps concerned. For the rest, the work done in this field is of such a character that the results can be used for the evaluation of multi-phase pumping in general. 77 figures, 19 tables.

4240 Pollution Control Equipment

REFER ALSO TO CITATION(S) 10971, 10973, 11701, 11713, 11733

11612 **(Juel-Spez—420) Construction of the cryosampler type V for air sampling in the stratosphere.** Muelheims, J. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Technische Dienste; Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Mechanische Werkstaetten). Oct 1987. 76p. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88756196/JAW.

The air samples are collected in descent in an overlapping way by cryotransfer on gilded cold fingers. The collected samples are used for the measurement of radical concentrations in the stratosphere. A height-dependent concentration profile of the radicals is achieved by this measuring method. The investigation of the HO/sub 2/ radicals, NO/sub 2/ radicals and OH radicals, which are important for the stratospheric degradation of ozone, is the main objective. The samples are analyzed in a measuring cryostat in the ESR spectrometer. The formaldehyde (CH/sub 2/O) also frozen out during the collection is measured after the ESR measurement and the thawing of the samples by means of high-pressure liquid chromatography (HPLC). The reconstruction of the cryosampler became necessary, because the old cryosampler type IV was destroyed in an accident.

11613 **(PB—89-120851/XAB) Overview of incineration performance.** Dempsey, C.R.; Oberacker, D.A. (Environmental Protection Agency, Cincinnati, OH (USA). Risk Reduction Engineering Lab.). Nov 1988. 24p. (EPA—600/D-88/230). NTIS, PC A03/MF A01.

During the early 1980s the EPA Office of Research and Development conducted field evaluations at eight hazardous-waste incinerators, eleven industrial boilers, and eight industrial furnaces to characterize their emission and assess the performance of these facilities to destroy hazardous waste. The results of these studies plus trial-burn data submitted by 14 RCRA applicants are summarized and compared with the 1982 hazardous-waste incinerator regulations and the proposed industrial-boiler and industrial-furnace regulations.

4250 Power Cycles

REFER ALSO TO CITATION(S) 11226, 11300, 11311

43 PARTICLE ACCELERATORS

REFER ALSO TO CITATION(S) 11947

11614 **(KURRI-TR—293) Development of advanced technology for scientific research.** Shibata, Toshikazu (ed.). (Kyoto Univ., Kumatori, Osaka (Japan). Research Reactor Inst.). Sep 1987. 15-21p. (In Japanese). (CONF-8608229—). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88780146/JAW.

From 7. symposium on the development of advanced technology for scientific research; Kumatori, Japan (19 Aug 1986).

Individual papers in these proceedings are indexed separately. (LEW)

11615 **(LAL-RT—87-12) TeV e/sup +/e/sup -/ linear colliders.** Le Duff, J. (Paris-11 Univ., 91 - Orsay (France). Lab. de l'Accelerateur Lineaire). Dec 1987. 38p. (In French). (CONF-8709294—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756162/JAW.

From 19. Ecole de Physique des Particules; Marseille-Luminy, France (7 Sep 1987).

The basic philosophy and performance and technical constraints of linear e/sup +/e/sup -/ colliders at TeV energies are summarized. Collider luminosity, pinch effects due to beam interaction, beam-beam bremsstrahlung, and typical parameters for an e/sup +/e/sup -/ linear collider are discussed. Accelerating structures, HF power sources, electron guns, positron production, and storage rings are considered.

4301 Design, Development, And Operation

REFER ALSO TO CITATION(S) 12145

11616 **(CERN-EP—88-122) How can we get intelligent systems close to experiments?.** Brock, R.K.; Ermolin, Y.; Krischer, W.; Ljuslin, C.; Lone, S.; Marchioro, A.; Zografos, K. (European Organization for Nuclear Research, Geneva (Switzerland)). 1 Sep 1988. 13p. (CERN-LAA/RT—88-07; CONF-8806243—14). NTIS (US Sales Only), PC A03/MF A01 - OSTI. Order Number DE89003207/JAW.

From DPF summer study: Snowmass '88 on high energy physics in the 1990s; Snowmass, CO, USA (27 Jun 1988).

For the high data rates expected at future multi-TeV hadronic colliders like the SSC, it is of utmost importance to take decisions in real time on partial data and as fast as possible. At a first level and shortest timescale, some customized electronics will reduce the rates. In a second phase, decisions have to use concepts closer to physics and hence imply the presence of some intelligence in the trigger. We consider various parallel computer or computer-like systems for their possibilities to be embedded as critical active elements in future detectors. We also discuss the present activities and the pilot systems being built up as part of the LAA project at CERN. These activities aim at a better understanding of existing commercial systems, their design, and their limits of performance. The ultimate aim is to integrate suitable system designs in a flexible way into the data acquisition electronics of future detectors, most likely in VLSI technology. 5 figs.

11617 **(CONF-8810242—5) Improved voltage performance of the Oak Ridge 25URC tandem accelerator.** Meigs, M.J.; Jones, C.M.; Haynes, D.L.; Juras, R.C.; Ziegler, N.F.; Raatz, J.E.; Rathmell, R.D. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 11p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005126/JAW.

From Symposium of Northeastern Accelerator Personnel; New Haven, CT, USA (24 Oct 1988).

While voltage performance of the accelerator has been adequate for the experimental program to date, it seemed clear that improvement in voltage performance could be of direct benefit to the experimental program in the future. Therefore, we began, in June 1986, a program of modifications and tests which was designed to improve voltage performance of the accelerator. In this paper, we discuss the final phase of this program and initial tests of the accelerator following completion of this final phase. 11 refs., 4 figs.

11618 **(DOE/EIS—0138-Vol.4-App.8) Superconducting Super Collider: Volume 4, Appendix 8: Final Environmental Impact Statement.** (USDOE, Washington, DC). Dec 1988. 75p. NTIS, PC A04/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004239/JAW.

This appendix is divided into four sections: 8.1, Purpose and Scope; 8.2, Technical Approach and Methodology; 8.3, Overview of Assessments; and 8.4, Resource Assessment. The assessment of air quality impacts in the DEIS was intended as a worst case analysis. This resulted in the DEIS evaluation that there would be some violations of ambient air quality standards (AAQS). These projected violations were raised as a major concern by commenters on the DEIS. The DOE will comply with all AAQS in the construction and operations of the SSC. Therefore, the final EIS analysis has been revised to include more efficient mitigation measures to bring the emissions from the SSC within standards. This Appendix also identifies additional mitigation measures (to further reduce emissions) that are available to the DOE if required. These measures can be considered as necessary after the selection of the SSC site, when more detailed analyses are performed for the Supplement to the EIS and permitting coordination with the State begins. Additional changes in the final EIS resulted from comments received on the DEIS and further refinements in analyses. 27 refs., 59 tabs.

11619 **(DOE/ER/40150—53) CEBAF: A superconducting radio frequency accelerator for nuclear physics.** Hartline, B.K. (Southeastern Universities Research Association, Newport News, VA (USA). Continuous Electron Beam Accelerator Facility). 1988. Contract AC05-84ER40150. 19p. (CEBAF-PR—88-014). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005548/JAW.

The Continuous Electron Beam Accelerator Facility (CEBAF) will be a 4-GeV, 200-μA superconducting recirculating linear accelerator to provide CW electron beams to simultaneous nuclear physics experiments in three end stations. Funded by the Department of Energy, CEBAF's purpose is basic research on the nuclear many-body system, its quark substructure, and the strong and electroweak interactions governing this form of matter. At the heart of the accelerator are niobium superconducting accelerating cavities designed at Cornell University and successfully prototyped with industry during the past three years. The cavities consistently exceed CEBAF's performance specifications (gradient $\geq$ 5 MV/m, $Q_0 \geq 2.4$ {times} 10^9 at 2 K and 5 MV/m). Construction is under way, and operation is scheduled in 1994. 26 refs., 9 figs., 3 tabs.

11620 **(DOE/FTR—9004960) [European particle accelerator conference, Rome, Italy, and visit to CERN, Geneva, Switzerland, June 6--June 18, 1988]: Foreign trip report.** Lee, S.Y. (Brookhaven National Lab., Upton, NY (USA)). 29 Jun 1988. Contract AC02-76CH00016. 5p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004960/JAW.

At the conference, we presented papers (oral and posters) and discussed the physics and technical problems with colleagues of other laboratories. We also discussed the issues on new experimental facilities. In CERN, Geneva, machine operation of PS and SPS for heavy ions and protons was discussed. New control systems in the planning stage were also discussed.

11621 **(DOE/FTR—9005079) [European accelerator conference, Rome, Italy, International Committee for Future Accelerators annual meeting and workshop, Capri Island, June 7--18, 1988]: Foreign trip report.** Palmer, R.B. (Brookhaven National Lab., Upton, NY (USA)). 3 Oct 1988. Contract AC02-76CH00016. 5p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005079/JAW.

I attended the European Accelerator Conference in Rome, Italy, June 7-11 and delivered an invited paper. On June 11 I attended the annual meeting of the International Committee for Future Accelerators. From June 13-17 I attended the ICFA Subcommittee Workshop on the Physics of Linear Colliders; I was the organizing chairman at this workshop, and gave two invited talks.

11622 **(DOE/FTR—9005087) [First European accelerator conference (EPAC), Rome, Italy, June 5--12, 1988]: Foreign trip report.** Courant, E.D. (Brookhaven National Lab., Upton, NY (USA)). 6 Jul 1988. Contract AC02-76CH00016. 5p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005087/JAW.

At the conference, many papers were presented on all aspects of accelerator work going on in Europe and elsewhere.

11623 **(DOE/FTR—9005118) [European particle accelerator conference, Rome, Italy, and visit to the LEP storage ring and LEP detectors L3 and ALEPH at CERN, Geneva, Switzerland, June 5-16, 1988]: Foreign trip report.** Blumberg, L.N. (Brookhaven National Lab., Upton, NY (USA)). 13 Jul 1988. Contract AC02-76CH00016. 52p. NTIS, PC A04/MF A01 - OSTI. Order Number DE89005118/JAW.

A selection of papers presented at the EPAC Conference relating to accelerator technology, facilities proposed, planned or under construction, and operating machines are discussed. Also noted are discussions at CERN with personnel from the LEP superconducting RF, the LEP L3 and ALEPH detectors, and the LHC superconducting magnet groups.

11624 **(FRCEA-TH—87) Contribution to the improvement of the double track resolution of the large solid angle detector Diogene.** Valette, O. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Physique Nucleaire; Paris-11 Univ., 91 - Orsay (France)). Oct 1986. 195p. (In French). NTIS (US Sales Only), PC A09/MF A01. Order Number DE88756135/JAW.

The equation of state and the properties of dense nuclear matter are of considerable theoretical interest. The experimental study of such a problem can only be done in the laboratory with relativistic heavy ions collisions. Since inclusive measurements have proven to be rather insensitive to the equation of state, large solid angle detectors have been developed to measure most of the charged particles emitted in these collisions. Such a detector, Diogene, can only accept up to about 40 particles. This limitation comes from the double track resolution of the detector. The interest for heavy colliding systems and the future improvement of the Saturne synchrotron showed the need for a change of the present electronics with a fixed integration time to a new sampling electronics. For comparative tests, such an electronics has been added to a small part of the detector, together with the existing system.

Charge-coupled devices (CCD) which offer a large dynamic range have been selected for such a purpose. The sampling frequency has been limited to 50 MHz because of present data acquisition constraints. The use of a simple algorithm has led to an improvement of the double track resolution, by a factor of three. A specific technique has been used to keep a good localisation in the transverse plane of the detector. It however has damaged somewhat the spatial resolution in the longitudinal direction. Therefore the whole detector equipment seems to require a 100 MHz sampling rate, although the present 50 MHz CCD electronics can already be used to help trajectory reconstruction.

11625 **(INP—1294/C) On the possibility of production of cyclotron isotopes applied in nuclear medicine and technics.** Kolaczkowski, A.; Mikulski, J.; Nowgorodow, A.F. (Institute of Nuclear Physics, Krakow (Poland); Joint Inst. for Nuclear Research, Dubna (USSR)). (Institute of Nuclear Physics, Krakow (Poland)). 1985. 13p. (In Polish). NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705293/JAW.

Radiochemical methods such as ion-exchange chromatography, static extraction, dynamic extraction and thermochromatography were applied to isolate the following nuclides: /sup 48/V, /sup 57/Co, /sup 67/Ga, /sup 111/In and /sup 169/Yb. The nuclides were obtained on the U-120 cyclotron in the Institute of Nuclear Physics, Cracow or on the synchrocyclotron in the Joint Institute of Nuclear Research, Dubna, USSR. Prospects for production of other neutron-deficient isotopes applied or to be applied in nuclear medicine are outlined. 10 refs., 2 tabs.

11626 **(KFK—4201) Upgrading the Lyon cluster ion accelerator by a radiofrequency quadrupole.** Moser, H.O.; Schempp, A. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Kernverfahrenstechnik; Frankfurt Univ. (Germany, F.R.). Inst. fuer Angewandte Physik). (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Kernverfahrenstechnik; Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Kernverfahrenstechnik; Frankfurt Univ. (Germany, F.R.). Inst. fuer Angewandte Physik). Feb 1987. 26p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756383/JAW.

The design is presented of an RFQ with variable final energy suitable to post-accelerate cluster ions from the Lyon electrostatic cluster-ion accelerator in the mass ranges from 1 to 25 μ and 1 to 50 μ to kinetic energies of 1.32-2.5 MeV and 2.64-5.0 MeV for cw and pulsed operation, respectively. Furthermore, a beam line is described which matches the electrostatically preaccelerated beam to the RFQ by use of electrostatic quadrupole triplets. When used without RFQ this beam line serves to improve beam parameters on the target, such as the particle flux density or beam divergence. The estimated costs of this project are about DM 345 000.- or FF 1 200 000.- without VAT.

11627 **(LBL—25760) The two-beam accelerator and the relativistic klystron power source.** Sessler, A.M. (Lawrence Berkeley Lab., CA (USA)). Apr 1988. Contract W-7405-ENG-48;AC03-76SF00098. 40p. (CONF-8804224—1). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89002673/JAW.

From Budker memorial seminar: international seminar on topics in high energy physics and controlled fusion; Novosibirsk, USSR (26 Apr 1988).

This paper discusses the concept of a two-beam accelerator. Two versions are discussed; one employing a free electron laser, the second employing a branched beam sent through "transfer cavities" as in a klystron. 14 refs., 26 figs., 1 tab. (LSP)

11628 **Radiofrequency quadrupole accelerators and their applications.** Stokes, R.H.; Wangler, T.P. (Accelerator Technology Division, Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Annual Review of Nuclear Science;* **38**: No. 1, 97-118(1988).

This review of Radiofrequency Quadrupole (RFQ) Accelerators contains a short history of Soviet and Los Alamos RFQ developments, RFQ beam dynamics, resonator structures, and the characteristics and performance of RFQ accelerators. (AIP)

4302 Beam Dynamics, Field Calculations, And Ion Optics

11629 **(BNL—42104) Calculation of aberration coefficients up to sixth order of multipole focusing elements.** Tsoupas, N.; Enge, H.A.; Forest, E. (Brookhaven National Lab., Upton, NY (USA)). 1988. Contract AC02-76CH00016. 3p. (CONF-881049—42; BNL/NPB—88-119). NTIS, PC A02/MF A01 - OSTI. Order Number DE89004526/JAW.

From Linear accelerator conference; Williamsburg, VA, USA (3 Oct 1988).

A method and a computer code have been developed to calculate the aberration coefficients, up to sixth order, for a focusing device consisting of magnetic or electric multipoles. The method is based on the calculation of the ray coordinates at the exit of a focusing device using the RAYTRACE code which provides the magnetic and electric multipole fields necessary for the integration of the equation of motion of the charged particles moving into the focusing device. Subsequently, the exit ray coordinates are considered as a Taylor series expansion, about the origin, in terms of the ray coordinates at the entrance. The coefficients of expansion are the aberration coefficients. The method to calculate the aberration coefficients is discussed further in the text. 5 refs., 1 fig., 1 tab.

11630 **(BNL—42126) Helical Siberian snakes.** Courant, E.D. (Brookhaven National Lab., Upton, NY (USA)). 1988. Contract AC02-76CH00016. 10p. (CONF-880983—21). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004891/JAW.

From 8. international symposium on high energy spin physics; Minneapolis, MN, USA (12 Sep 1988).

To eliminate spin resonances in circular accelerators "Siberian Snakes" may be inserted at one or more azimuths in such a way that the overall spin precession tune ν/sub s/ equals 1/2. A snake is a sequence of horizontal and vertical deflection magnets whose overall effect is to rotate the spin by π about an axis in the plane of the orbit, either longitudinal or transverse or any angle {var←phi} in between. At the same time the magnets of the snake should be arranged so as to produce zero net deflection and displacement of the particle orbit. We investigate here how the orbit deflections can be made small by using helical deflecting magnets rather than discrete horizontal and vertical deflectors.

11631 **(CERN-EP—88-108) From electron cooling to antihydrogen: A personal view.** Poth, H. (European Organization for Nuclear Research, Geneva (Switzerland)). 30 Aug 1988. 18p. (CONF-8804224—2). NTIS (US Sales Only), PC A03/MF A01 - OSTI. Order Number DE89003200/JAW.

From Budker memorial seminar: international seminar on topics in high energy physics and controlled fusion; Novosibirsk, USSR (26 Apr 1988).

Some milestones in the evolution of electron cooling are recounted. The main results of electron cooling are briefly summarized. A selection of experimental data from LEAR and Novosibirsk is presented. The future applications of electron cooling for beam cooling and for atomic physics are discussed in some detail. 46 refs., 6 figs., 2 tabs.

11632 **(CONF-8806101—7) Comparison of simulation, theory and measurement for the Maryland Transport Experiment.** Rudd, H.; Haber, I.; Chang, C.R.; Kehne, D.; Low, K.; Reiser, M.; Shea, T. (Maryland Univ., College Park (USA)). 1988. Contract AC05-85ER40216. 15p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005398/JAW.

From International symposium on heavy ion inertial fusion; Darmstadt, F.R. Germany (28 Jun 1988).

The evolution of measured beam characteristics such as emittance and radius, as well as details of the beam cross section, have been compared with both theory and simulation, and substantial agreement has been obtained. Simulations have also been employed to identify those deviations from an idealized transport system, such as mismatch and misalignment, which are likely to be the cause of emittance growth in excess of what was expected for the ideal system. 9 refs., 3 figs.

11633 (DOE/ER/40302—T1) Particle dynamics in a wave with variable amplitude: Progress report. Cary, J.R. (Colorado Univ., Boulder (USA). Dept. of Astrophysical, Planetary, and Atmospheric Sciences). Jan 1989. Contract FG02-86ER40302. 29p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number TI89005388/JAW.

In the last year progress in studies of transport through accelerator phase space due to separatrix crossing, use of Hamilton-Jacobi methods to obtain invariant surfaces of accelerators, and analysis of accelerators via closed orbits has been made. The diffusion due to separatrix crossing has been shown to be within a factor of two of the random phase prediction. A two-dimensional Hamilton-Jacobi solver developed in the last year will be improved by including the Broyden update method for calculating the Jacobian. Optimization of accelerator systems using the residue minimization technique has begun. 29 refs., 6 figs.

11634 (Juel-Spez—382) Ion-optical layout of a synchrotron and storage ring with electron cooling (COSY) as well as studies on the phase space behaviour of the beam with an internal target. Prasuhn, D. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Kernphysik; Bonn Univ. (Germany, F.R.)). Nov 1986. 143p. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88756379/JAW.

The discussion of the design for COSY presented in this thesis has shown that it is possible to conceive a storage ring which fulfils the requirements for a series of different experiments. The present design exhibits the neccessary variability in the ion optics in order to optimize the beam properties for a manifold of requirements, for instance high dispersion and kinematical fitting to a certain target position for high-resolution experiments, fitting of the beam properties to the electron cooler, fitting of the ion optics to requirements of the injection, and requirements for high mean luminosity and long stand-by times. In order to perform an experiment - especially with internal target - under optimal conditions however also for the experimentator good knowledges of the possible operational modes of the storage ring are condition.

11635 (SAND—88-1119) BUCKSHOT-MAGIC comparison for RADLAC conditioning cell parameters. Wagner, J.S.; Poukey, J.W.; Leifeste, G.T. (Sandia National Labs., Albuquerque, NM (USA)). Nov 1988. Contract AC04-76DP00789. 76p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89005299/JAW.

BUCKSHOT, a new 3-D particle code in the magnetostatic-paraxial limit, and MAGIC, a well-tested 2-D particle code which solves the complete set of Maxwell's equations, have been benchmarked against each other using RADLAC conditioning cell parameters. Comparisons of the beam dynamics in both codes show excellent agreement. In the future, BUCKSHOT should be useful in studying RADLAC conditioning cells because it is 3-D. This allows BUCKSHOT to study off-axis beam displacements, which can excite hose-related instabilities in RADLAC beams. 1 ref., 7 figs.

11636 LIE algebraic treatment of linear and nonlinear beam dynamics. Dragt, A.J.; Neri, F.; Rangarajan, G.; Douglas, D.R.; Healy, L.M.; Ryne, R.D. (Center for Theoretical Physics, University of Maryland, College Park, Maryland 20742). *Annual Review of Nuclear Science;* **38**: No. 1, 455-496(1988).

The purpose of this paper is to present a summary of new methods employing Lie algebraic tools for characterizing beam dynamics in charged- particle optical systems. These methods are applicable to accelerator design, charged-particle beam transport, electron microscopes, and also light optics. The new methods represent the action of each separate element of a compound optical system, including all departures from paraxial optics by a certain operator. The operators can then be concatenated following well defined rules to obtain a resultant operator that characterizes the entire system. (AIP)

4303 Auxiliaries And Components

REFER ALSO TO CITATION(S) 11630

11637 (BNL—41509) RFQ preinjectors. Alessi, J.G. (Brookhaven National Lab., Upton, NY (USA)). 1988. Contract AC02-76CH00016. 17p. (CONF-881151—50). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004888/JAW.

From International conference on the application of accelerators in research and industry; Denton, TX, USA (7 Nov 1988).

The Radio Frequency Quadrupole (RFQ) accelerator has become the method of choice as a preinjector for many proton and heavy ion linacs injecting into synchrotrons, and can be used for injection directly into small synchrotrons. In addition to its use in most new preinjector lines being built or proposed, several laboratories have replaced Cockcroft-Walton accelerators with RFQs. Among the advantages of the RFQ are its simplicity and reliability, compact size, and relatively low cost. The fact that the ion source is located nearly at ground potential is also very advantageous. A survey of operating RFQ preinjectors is given, as well as the status of some RFQ preinjectors which are presently under development. 25 refs.

11638 (BNL—42001) Mechanical design of a rf electron gun. Woodle, M.H.; Batchelor, K.; Sheehan, J. (Brookhaven National Lab., Upton, NY (USA)). 1988. Contract AC02-76CH00016. 2p. (CONF-881049—52). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004890/JAW.

From Linear accelerator conference; Williamsburg, VA, USA (3 Oct 1988).

Brookhaven National Laboratory is building an Accelerator Test Facility at which we plan to study laser acceleration of electrons inverse free electron lasers and the production of X-rays by non- linear Compton scattering. The facility contains an electron gun, linac, lasers and ancillary systems which will enable the production of 6 ps duration pulses of 50--100 MeV electrons. The electron source is an one and one half cell RF Electron gun which utilizes either a thermionic or photoemissive cathode to produce 5 MeV electrons. This paper discusses how gun mechanical design considerations such as material, vacuum maintenance, surface finish, fabrication methods, cavity tuning, and cathode replacement were reconciled to arrive at the final design. 9 refs., 2 figs., 2 tabs.

11639 (BNL—42082) Progress with the AGS Booster. Weng, W.T. (Brookhaven National Lab., Upton, NY (USA)). 1988. Contract AC02-76CH00016. 4p. (CONF-8806243—11). NTIS, PC A02 - OSTI. Order Number DE89004525/JAW.

From DPF summer study: Snowmass '88 on high energy physics in the 1990s; Snowmass, CO, USA (27 Jun 1988).

Rare K-decay, neutrino and heavy ion physics demands that a rapid- cycling high vacuum and high intensity Booster be built for the AGS at Brookhaven. For each mode of operation there are corresponding accelerator physics and design issues needing special attention. Problems pertinent to any single mode of operation have been encountered and solved before, but putting high intensity proton requirements and high vacuum heavy ion requirements into one machine demands careful design considerations and decisions. The lattice design and magnet characteristics will be briefly reviewed. Major design issues will be discussed and design choices explained. Finally, the construction status and schedule will be presented. 6 refs., 6 figs.

11640 (DOE/FTR—9005080) [Evaluation of the electrical connections of the HERA superconducting magnets, Hamburg, Germany, Belfort, France, and Schio, Italy, February 27--March 8, 1988]: Foreign trip report. Cottingham, J.G.; Greene, A.F. (Brookhaven National Lab., Upton, NY (USA)). 8 Mar 1988. Contract AC02-76CH00016. 14p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005080/JAW.

This report describes work done by the travelers to evaluate the electrical connections of the HERA superconducting magnets.

The recommended changes to the magnets are described here. Also, there are comments about the companies doing the work, Alsthom and Zanon, and about the schedules for magnet production.

11641 **(DOE/FTR—9005085) [Discussions on the design of the BNL LESB III electrostatic beam separators, Tsukuba-shi, Japan, June 5--11, 1988]: Foreign trip report.** Sandberg, J.; Walker, J. (Brookhaven National Lab., Upton, NY (USA)). 27 Jun 1988. Contract AC02-76CH00016. 10p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005085/JAW.

Jon Sandberg and John Walker, engineers in the AGS Department of Brookhaven National Laboratory (BNL), made a trip to Japan to discuss the design of the new BNL LESB III electrostatic beam separators with representatives of the Japanese National Laboratory for High Energy Physics (KEK) and to investigate the performance of the +-400 kV power supplies KEK is loaning to BNL. It is BNL's intention to use these power supplies to energize the LESB III separators and to eventually purchase several additional units from their manufacturer, Nichicon Capacitor Company. It is believed that Nichicon is the only source of power supplies of this type. The operational aspects of the KEK main magnet power supply was also investigated.

11642 **(DOE/FTR—9005113) [International workshop on constructing 1-2 GeV synchrotron radiation facilities, Taipei, China, February 20--March 5, 1988]: Foreign trip report.** Galayda, J. (Brookhaven National Lab., Upton, NY (USA)). 1988. Contract AC02-76CH00016. 5p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005113/JAW.

The SRRC Project of Taiwan will produce a 1.3--1.5 GeV high-brightness storage ring for synchrotron radiation research. The purpose of the project is to provide a first-rate experimental facility for the use of Taiwanese researchers who would otherwise carry on their work in the US or Europe. It is scheduled for completion before the end of 1992. The purpose of the workshop was to review the conceptual design described in the SRRC Status Report of January 1988 and to survey the design features of synchrotron radiation facilities and projects elsewhere in the world. Certain design decisions were precipitated by the workshop, such as the choice of an aluminum vacuum system and the first specification of the required clear aperture of the beampipe. Of the talks given by visitors from other laboratories, the most notable were by Katsura and Huke from the KEK Photon Factory. They reported on correlations of beam motion with seasonal temperature changes. They also described a very interesting feedback orbit control algorithm running in the facility control computer. The magnet field mapping facility, built for measuring the curved storage ring dipoles, is operational. In measuring an early prototype dipole, its performance was very good: measurements repeated to a few parts in 10,000. Positional accuracy is of a high order, about 0.0005", and the worst error (position-dependent vertical tilt of the Hall probe, 0.004") can easily be cut in half.

11643 **(DOE/FTR—9005114) [First European particle accelerator conference, Rome, Italy, and visit to CERN, Geneva, Switzerland, June 6--12, 1988, June 27--July 3, 1988]: Foreign trip report.** Prelec, K. (Brookhaven National Lab., Upton, NY (USA)). 18 Jul 1988. Contract AC02-76CH00016. 3p. NTIS, PC A02/MF A01 - OSTI. Order Number DE89005114/JAW.

The primary purpose of the trip was to present two papers at the EPAC, Rome, entitled "Extraction of a Steady State Electron Beam from HCD Plasmas for EBIS Applications" and "A Pulsed, High Current Volume H/sup {minus}/ Source for Accelerator Applications." Many discussions with other participants at the conference were held during the meeting. As a followup of previous visits, the author also spent a week at CERN, this time to discuss projects of common interest to both BNL and CERN; these projects include negative ion sources, heavy ion acceleration, ion optics and RFQ acceleration. Per diem costs while in Geneva were paid by CERN.

11644 **(DOE/FTR—9005115) [European particle accelerator conference, Rome, Italy, and visit to heavy ion accelerator laboratory, GSI, Darmstadt, West Germany, June 6--16, 1988]: Foreign trip report.** Brennan, J.M. (Brookhaven National Lab., Upton, NY (USA)). 9 Sep 1988. Contract AC02-76CH00016. 17p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89005115/JAW.

The purpose of the trip was to attend and present two papers at the European Particle Accelerator Conference which was held at Rome, Italy, from June 7-11, 1988, and to visit the heavy ion accelerator laboratory, GSI, at Darmstadt, West Germany. The accelerator conference included many areas of accelerator technology, especially rf devices and techniques, that are relevant to the Brookhaven Booster construction project and the AGS upgrade effort. The GSI laboratory is in the final stages of construction of a heavy ion synchrotron whose parameters, ion species, beam intensities, energy, and rf frequency, match closely with the Brookhaven Booster. The author spoke with individuals concerning their solutions to problems that we have in common in the areas of: beam diagnostic instrumentation, position and intensity monitors; and wideband rf accelerating cavities, ferrite dynamical behavior, and closed-loop tuning control. The possibility of purchasing from GSI a critical component of the Booster beam position monitoring system was discussed in detail and is being actively pursued at this time.

11645 **(INP—1286/PL) Fast data transfer system between PDP11/10 and SM-4 computers.** Kantor, W. (Institute of Nuclear Physics, Krakow (Poland)). 1985. 15p. (In Polish). NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705288/JAW.

A fast data transfer up to 250 Kbytes/sec is described. The system allows fast data transfer between PDP11/10 minicomputer, which works as a CADOS (a data acquisition system) control unit, and SM-4 (PDP11/40 compatible) in any direction. The data transfer is controlled by appropriate software. 3 refs.

11646 (JINR-D—9-87-105(v.1), pp 263-267) **Accelerating voltage generator of the Kurchatov's Atomic Energy Institute cyclotron.** Bel'kov, A.I.; Dushin, V.V.; Zharov, S.Yu.; Kakunov, I.I.; Komissarov, P.Yu.; Latushkin, S.T.; Yudin, L.I. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1987. (In Russian). NTIS (US Sales Only), PC A20/MF A01. Order Number DE89780040/JAW. (CONF-8610271—).

From 10. All-Union conference on charged-particle accelerators; Dubna, USSR (21 Oct 1986).

The generator (GU-300) of the Kurchatov's Atomic Energy Institute is replaced by a new one, based on PKV-200 broadcast transmitter. A series of structural and circuitry developments is carried out to use transmitter in cyclotron HF-supply system. Operation of a new HF generator with additional control and monitor devices sufficiently increased cyclotron reliability and quality of operation, simplified and reduced to several minutes re-tuning of HF channel, provided an increase of accelerating voltage stability. Availability of electromechanical drive for controlling frequency re-tuning circuits and high-voltage anode rectifier with thyristor control promotes development of control automation and smooth retuning of generator frequency and, hence, energy of accelerated particles. Several years of generator operation confirmed its high performance. 4 refs.; 5 figs.; 1 tab.

11647 **(Juel-Spez—454) Design and construction of a one-stage broad-band amplifier optimized for 20K noise and amplification for the signal processing in the stochastic cooling at the cooler synchrotron COSY.** Danzglock, R. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Projektleitung COSY). Jun 1988. 62p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88756381/JAW.

In the present report a microwave preamplifier for the signal preparation of the stochastic cooling at the storage ring COSY is presented. (orig./HSI).

11648 **(LA-UR—88-3909) SSC linac injector.** Bhatia, T.S.; Guy, F.W.; Neuschaefer, G.H.; Pabst, M.; Schriber, S.O.; Stovall, J.E.; Wangler, T.P.; Wilson, M.T.; Worth, G.T. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 11p. (CONF-8806243—13). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89003557/JAW.

From DPF summer study: Snowmass '88 on high energy physics in the 1990s; Snowmass, CO, USA (27 Jun 1988).

The parameters for the proposed SSC linac injector system are obtained from the established requirements of the low-energy booster (LEB). The first element of this injector system is a radio-frequency quadrupole (RFQ) that bunches the H/sup {minus}/ ions and accelerates these ion bunches to 2.5 MeV. With a suitable matching section, this beam is injected into a drift-tube linac (DTL), which takes the ions to 120 MeV. The final element is a coupled-cavity linac (CCL) designed to accelerate the H/sup {minus}/ ions to 600 MeV for injection into the LEB. The conceptual beam dynamics design for the various elements of this linac injector system are described. 4 refs., 5 figs., 4 tabs.

11649 **(LAL-RT—88-01) Positron beam for the linear collider scheme of a B-meson factory.** Chehab, R. (Paris-11 Univ., 91 - Orsay (France). Lab. de l'Accelerateur Lineaire). Feb 1988. 27p. (CONF-871299—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756163/JAW.

From Workshop on heavy quarks factory and nuclear physics facility with superconducting linacs; Courmayeur, Italy (14 Dec 1987).

An approach for a conventional positron source intended to a BantiB linear collider scheme is here given. Optical matching devices between the source and the accelerator are considered and some comparisons are made regarding the maximum acceptance and the positron beam qualities. Focusing in the preaccelerator and in the main linac are also considered. Heating and radiation problems which may introduce severe limitations are only partly examined.

11650 **(TRI-PP—88-73) Tensor polarization in a deuterium target of non-uniform spin temperatures.** Wait, G.D. (TRIUMF, Vancouver, British Columbia (Canada)). Sep 1988. 5p. (CONF-880983—22). NTIS (US Sales Only), PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005051/JAW.

From 8. international symposium on high energy spin physics; Minneapolis, MN, USA (12 Sep 1988).

Calculations are described which allow for the measurement of the tensor polarization of a polarized deuterium target which has a distribution of spins. The tensor polarization can be determined uniquely providing a careful measurement of the vector polarization is made by the TE method and an accurate determination is made of the asymmetry of the NMR spectrum. The correct value for the average tensor polarization is between the value obtained from the TE method and that obtained from the asymmetry method. 11 refs., 4 figs.

11651 **(TRI-PP—88-86) Recent results from the TRIUMF optically pumped polarized ion source.** Levy, C.D.P.; Law, W.M.; McDonald, M.; Schmor, P.W. (TRIUMF, Vancouver, British Columbia (Canada)). 1988. 3p. (CONF-880983—24). NTIS (US Sales Only), PC A02/MF A01 - OSTI. Order Number DE89005053/JAW.

From 8. international symposium on high energy spin physics; Minneapolis, MN, USA (12 Sep 1988).

The TRIUMF optically pumped polarized H/sup {minus}/ ion source has been installed on the TRIUMF cyclotron. Initial results are 0.5 μA dc beam with 43% polarization at 290 MeV. This is expected to be improved upon with normal troubleshooting. A superconducting solenoid to be installed within the next few months will allow a significant further increase in both polarization and beam current 7 refs., 3 figs.

4304 Storage Rings

REFER ALSO TO CITATION(S) 11634, 12191, 12212

11652 **(DOE/FTR—9005078) [13th meeting of the HERA Machine Committee, Hamberg, West Germany, June 20--25, 1988]: Foreign trip report.** Reardon, P.J. (Brookhaven National Lab., Upton, NY (USA)). 5 Oct 1988. Contract AC02-76CH00016. 10p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005078/JAW.

The traveler attended the 13th Meeting of the HERA Machine Committee that was held on June 22-23, 1988 at the DESY Laboratory in Hamburg, West Germany. This meeting consisted of discussions and a general progress report. Some of the topics covered were: measurement of non-persistent current effects, nonlinear acceptance of the proton ring, Petra II, status of the SC cavity development for HERA, warm magnets for the P-Ring, warm vacuum system for the P-Ring, SC magnet measurement facilities, and P-Ring schedule.

11653 **(Juel-Spez—437) Effect of an internal target on the beam behaviour in a storage ring.** Diehl, N. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Projektleitung COSY). Apr 1988. 115p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88756380/JAW.

For the study of the effects of an internal target on the beam behaviour in a storage ring a Monte Carlo simulation program was developed. Special importance was attached to the ranges of validity of the used models. The dominating effects are the Coulomb scattering of the projectiles on the target nuclei, which lead to an angular dispersion, and the collisions of the projectiles on the electrons of the target atoms which cause an energy loss. The target effects are regarded in the simulation program. The simulation calculations for the storage ring COSY give cause for the hope that experiments with internal targets because of high luminosity represent an interesting alternative in spite of thin targets. (orig./HSI).

11654 **Coherence effects in long-wavelength infrared synchrotron radiation emission.** Williams, G.P.; Hirschmugl, C.J.; Kneedler, E.M.; Takacs, P.Z.; Shleifer, M.; Chabal, Y.J.; Hoffmann, F.M. (National Synchrotron Light Source, Brookhaven National Laboratory, Upton, New York 11973). *Physical Review Letters;* **62**: No. 3, 261-263(16 Jan 1989).

We report measurements of synchrotron radiation emission in the wavelength region from 30 to 400 μm where coherent enhancement was predicted. The power ratio relative to a blackbody source exhibits no such enhancement and can be accounted for by the incoherent emission theory. This discrepancy is explained by showing that the coherent enhancement is reduced when proper account is taken of the relative phases of all emitting particles.

44 INSTRUMENTATION

4401 Radiation Instrumentation

REFER ALSO TO CITATION(S) 11020, 11063, 11064, 11065, 11066, 11410, 11624, 12144, 12167, 12248, 12252, 12279, 12310, 12314, 12325, 12328

11655 **(BARC—1384) Solid state neutron detector for measurement of thermal neutron flux in narrow conduits.** Gubbi, G.K.; Burte, P.P.; Srikantiah, R.V. (Bhabha Atomic Research Centre, Bombay (India). Radiochemistry Div.; Bhabha Atomic Research Centre, Bombay (India). Technical Physics and Prototype Engineering Div.). (Bhabha Atomic Research Centre, Bombay (India)). 1987. 12p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704077/JAW.

Technique for the fabrication of silicon surface barrier detector is described. Detectors are prepared from n type silicon of resistivity 1000 ohm-cm and had an active area of 76mm/sup 2/. 150 μg/cm/sup 2/ of enriched /sup 6/Li is vacuum deposited on the

gold surface of the detector as neutron sensitive material. The detector has been calibrated and used for the thermal flux measurement at thermal column TC-5 of APSARA Reactor. Miniature neutron detector has been developed for flux measurements in very narrow channels. (author). 4 figures.

11656 **(BARC—1388) Design studies of a proton-pion hodoscope.** Charagi, S.K.; Gupta, S.K.; Chatterjee, A. (Bhabha Atomic Research Centre, Bombay (India). Reactor Analysis and Systems Div.; Bhabha Atomic Research Centre, Bombay (India). Nuclear Physics Div.). (Bhabha Atomic Research Centre, Bombay (India)). 1987. 55p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88704080/JAW.

The considerations for the design of a detector assembly for detecting pions and protons resulting from the decay of Δ/sup +/ in the reaction /sup 6/Li(p,Δ/sup ++/)/sup 6/He at 400-500 MeV are discussed. The details of a computer program to calculate efficiencies for different hodoscope geometries and numerical results for some specific cases are given. A method for reconstructing the full kinematics of a reaction event from the position information of particle hits in the hodoscope is presented.

11657 **(BNL—42114) Fundamental principles of particle detectors.** Fernow, R.C. (Brookhaven National Lab., Upton, NY (USA)). 1988. Contract AC02-76CH00016. 35p. (CONF-8807141—1). NTIS, PC A03/MF A01 - OSTI. Order Number DE89004561/JAW.

From Summer school on hadron. spectroscopy; College Park, MD, USA (24 Jul 1988).

This paper goes through the fundamental physics of particles-matter interactions which is necessary for the detection of these particles with detectors. A listing of 41 concepts and detector principles are given. 14 refs., 11 figs.

11658 **(CEA-N—2575) Calibration of a gamma spectrometer for use in atmospheric radioactivity direct measurement.** Lam-Seck J. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. d'Electronique et d'Instrumentation Nucleaire; Strasbourg-1 Univ., 67 (France)). Sep 1988. 188p. (In French). NTIS (US Sales Only), PC A09/MF A01. Order Number DE88756432/JAW.

The aim of this work is the experimental determination of the minimum detectable activity per unit volume of a homogeneous distribution of an artificial radionuclide in the atmosphere by the means of gamma-ray spectrometry. The measurement of the full energy peak area of a 3" X 3"NaI (T1) detector and a lithium drifted germanium Ge(Li) detector with an active volume of about 58 cm/sup 3/, using different isotropic point gamma-ray sources of /sup 133/Ba (356 KeV), /sup 137/Cs (661.6 KeV) and /sup 60/Co (1173.2 KeV), for various source-detector distances, enables to evaluate the low limit of detection for these gamma-ray emitters. The application of a simple method makes possible to deduce an estimated value of the minimum detectable activity, in the presence of a given background level, of these radionuclides supposed to be distributed homogeneously in the atmosphere.

11659 **(CONF-880546—45) Monte Carlo calculated response of the dual thin scintillation detector in the sum coincidence mode.** Duvall, K.C.; Johnson, R.G. (National Bureau of Standards, Washington, DC (USA)). 1988. Contract AI01-86ER40275. 3p. NTIS, PC A02 - OSTI. Order Number DE89004814/JAW.

From International conference on nuclear data for science and technology; Mito, Japan (30 May 1988).

The Dual Thin Scintillator (DTS) is a unique neutron detector that is being developed for improved fluence and spectrum measurement. Current attention has been directed towards understanding some details of the detector response in the sum coincidence mode of operation where a peaked pulse height response is exhibited throughout the energy region of interest. As a result of the peaked distribution, the detector efficiency is a weak function of the pulse height bias, allowing the number of recorded events above the bias to be determined with greater certainty. A Monte Carlo code has been used to calculate the sum coincidence pulse height response at several energies within the 1 to 15 MeV region. The detector efficiency as a function of neutron energy has also been calculated. The results of the Monte Carlo calculations, which include the effect of multiple scattering on the shape of the response function and efficiency curve are presented.

11660 **(DOE/ER/40281—3) [Relativistic heavy ion research]: [Progress report, November 15, 1987--November 14, 1988].** Nagamiya, Shoji. (Columbia Univ., New York (USA)). [1988]. Contract FG02-86ER40281. 5p. NTIS, PC A02/MF A01 - OSTI. Order Number DE89003813/JAW.

The present document describes our third-year application for a continuation grant on relativistic heavy-ion research at Nevis Laboratories, Columbia University over the three-year period starting from November 15, 1986. Our progress during the current budget period is described for segmented Cerenkov and streamer-tube back counters; data analysis; and R and D for future experiments at AGS.

11661 **(DOE/ER/40325—13-A) Experimental study of diffractive processes in CDF [Collider Detector at Fermilab] at $\sqrt{s}$ = 1.8 TeV.** Goulianos, K. (Rockefeller Univ., New York (USA)). 1988. Contract AC02-87ER40325. 8p. (CONF-8810264—3; RU—88/E-25). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005037/JAW.

From Conference on hadronic matter in collision; Tucson, AZ, USA (6 Oct 1988).

The Collider Detector at Fermilab (CDF), a general purpose detector designed to study {bar p}p interactions at the Tevatron, incorporates apparatus for the study of diffractive processes, such as elastic scattering and diffraction dissociation. The heart of this apparatus comprises two "leading particle spectrometers", one on each side of the interaction region, which utilize the Tevatron magnets to analyze the momentum of leading particles in the region $1 - x < 0.1$ and $\theta < 1$ mrad. In this paper we describe briefly the physics goals, apparatus and run plan of CDF for the study of diffractive processes at $\sqrt{s}$ = 1.8 TeV. 1 ref., 3 figs.

11662 **(DOE/ER/40437—1) Calorimeter measurements in relativistic heavy-ion collisions: Progress report for the fiscal year March 15, 1988--March 14, 1989.** Wolf, K.L. (Texas A and M Univ., College Station (USA). Cyclotron Inst.). Nov 1988. Contract FG05-88ER40437. 33p. NTIS, PC A03 - OSTI. Order Number DE89004368/JAW.

The present progress report outlines the research goals, which remain essentially unchanged from those discussed in the original DOE proposal. The study of the equation of state of nuclear matter is a primary area, and at BNL there will be a search for signs of the quark-gluon plasma or at least the mixed phase, using the total event structure as discussed later. The calorimeter design and construction is discussed and some background information about the project is given. Finally an appendix contains several technical reports which were prepared during the calorimeter construction as a matter of procedure for this large project. 16 refs., 13 figs.

11663 **(EUR—11346) Recent developments in the technology of scintillator detectors for gamma-ray spectroscopy.** Verdebout, J. (Commission of the Europan Communities, Ispra (IT). Joint Research Centre). (Commission of the European Communities, Luxembourg). 1988. 58p. NTIS (US Sales Only), PC A04/MF A01. Order Number TI88756245/JAW.

The goal of this report is to review the recent developments in the use of high stopping power materials and solid state readout for scintillation gamma -ray spectroscopy as these techniques may give rise to a new generation of low powered portable instruments. The report is a bibliographical study based on papers published mainly these last five years. The main subject is preceded by a general introduction in which the principal characteristics of a scintillator gamma-ray spectrometer are discussed. The properties of some scintillator materials (NaI(T1), CsI(T1), CsI(Na), BGO, GSO(Ce) and CdWO/sub 4/) are then briefly presented. In this section, a special emphasis has been given to BGO as this material has recent-

ly received much attention and is now well documented. Finally, the results obtained by measuring the intensity of the light generated in the crystal with three types of solid-state photodetectors (Si photodiodes, HgI/sub 2/ photodetectors and avalanche Si photodiodes) are summarized.

11664 (FRCEA-TH—83) Current pulses sampling by flash analog/digital converters and evaluation of the method. Jolly, A. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Service de Physique Nucleaire a Moyenne Energie; Conservatoire National des Arts et Metiers (CNAM), 75 - Paris (France)). Jun 1987. 128p. (In French). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88756247/JAW.

The electronic equipment of the 4π steradian Diogene detector uses the following principle: an analog and time controlled integration is applied to the signal. Since this integration remains active during a fixed time, double track resolution perfomance is limited. The probability of piled up pulses increases with the multiplicity of events detected in drift chambers. This induces wrong values for informations the current division method gives. To allow the separation and the treatment of each pulse, the envelope over a wellknown baseline must be acquired. So we develop a sampling system around Flash Analog/Digital Converters. First, we calculate the standard deviation in the measurement of the Z position along sensitive wires in the detector, as a result of digitization error. Calculations allow us to choose parameters and the number of coding bits we need in 3 possible coding shemes. We show that a cascade, (7 bits) built with 2 Flash converters in front of which a logarithmic transfer fonction is inserted, makes amplitude dynamic compatible with Z position measure. Then, we propose some solutions to realize the prototype, to resolve electronic problems concerning synchronism and high frequencies requirements. At last, a test sequency is performed to characterize the quality obtained. Clock and logic circuits parasitic signals influence, differential linearity and typical pulses reproducibility determine the highest suitable sampling frequency, equal to 83 MHz.

11665 (INIS-mf—11332, pp 16) **Gamma spectrometrical examination of irradiated fuel.** Kristof, E.; Pregl, G. (Institut Jozef Stefan, Ljubljana (Yugoslavia)). 1988. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705189/JAW. (CONF-8809213—).

From IAEA Meeting: 10th European TRIGA users' conference; Vienna, Austria (14 Sep 1988).

11666 (INIS-mf—11340) Electromagnetic compatibility. Leszkow, P.; Dufek, J.; Vlcek, B.; Dobes, S. (Tesla, Premysleni (Czechoslovakia). Vyzkumny Ustav Pristroju Jaderne Techniky). 20 Nov 1987. 63p. (In Czech). NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS. Order Number DE88705272/JAW.

Dose and dose rate monitor NB 3201, picoammeter NC 0102 and the NS 9503 detection unit body with scintillation detector DS 104 were tested. The measurement of magnetic compatibility was made using a generator of disturbing pulses. A detailed description is presented of the electronic and structural design of the generator. Tests were made using the magnetic component of the disturbing field in a frequency range of 200 Hz to 10 MHz; also tested was disturbance at supply connectors. The results are tabulated. It was found that detection units are resistant to the magnetic field. (E.S.). 3 refs., 35 figs., 12 tabs.

11667 (INIS-mf—11872) On the optimization of the energy resolution of hadron calorimeters. Bernardi, E. (Hamburg Univ. (Germany, F.R.). Fachbereich Physik). 20 Jan 1988. 193p. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88756365/JAW.

Measurements on hadron sampling calorimeters are presented. The calorimeters consisted of lead or depleted uranium plates and of scintillator plates of different thicknesses. Design properties which influence the energy resolution were investigated. It is shown that the thickness of absorber- and scintillator plates is a very important parameter. The absorber material and plate thickness leading to the optimum energy resolution of a hadron calorimeter are determined. The measurements on hadron sampling calorimeters show that the energy resolution of such instruments can be optimized if one reduces parts of the strongly fluctuating fraction of nondetectable energy. The hadronic energy resolution of a lead-scintillator calorimeter with a thickness ratio of passive to active absorber of R/sub d/=0.95 is measured to σ/sub E//E (h)=41.0%/$\sqrt{E}$[GeV] +6.1% between 3 and 9 GeV. The e/h-ratio is $<e/h>=1.34$ and its deviation from 1 causes the large additive term in the hadronic energy resolution. The energy resolution for hadrons improves for a depleted uranium-scintillator calorimeter of R/sub d/=0.64 to $\sigma E/E$ (h)=29.6%/$\sqrt{E}$[GeV] +3.2% between 3 and 9 GeV at $<e/h>=1.10$. With a depleted uranium-scintillator calorimeter of R/sub d/=2.0 one can achieve overcompensation, i.e. $<e/h>=0.76$, at an hadronic energy resolution of $\sigma E/E$ (h)=37.7%/$\sqrt{E}$[GeV] +3.4% between 5 and 40 GeV. The optimum energy resolution of $\sigma E/E$ (h)=32.9%/$\sqrt{E}$[GeV] +0.5% between 10 and 100 GeV at $<e/h>=1.00$ is achieved for R/sub d/=1.07. Starting from predictions obtained from Monte Carlo calculations, compensation is also achieved with a lead-scintillator calorimeter for R/sub d/=4.0. The measured energy resolution is $\sigma E/E$ (h)=44.2%/$\sqrt{E}$[GeV] between 3 and 75 GeV at $<e/h>=1.05$.

11668 (IPEN-Pub—134) Determination of x-radiation exposure rates from color television sets. Campos, L.L.; Caldas, L.V.E. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo, SP (Brazil)). May 1988. 8p. (In Portuguese). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704153/JAW.

The exposure rates of low energy X-rays emitted from color televisions were determined by thermoluminescence using CaSO/sub 4/:Dy + Teflon pellets. The measurements were taken at the distances of 5 cm, 2 and 3 m in front of the screens. The results were compared with those obtained for video display terminals at the same experimental conditions.

11669 (IPEN-Pub—145) Determination of the gamma radiation scattering with geometry changes in the system. Albuquerque, M. da P.P.; Xavier, M.; Caldas, L.V.E. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo, SP (Brazil)). Jul 1988. 14p. (In Portuguese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704158/JAW.

Three different experimental systems were used for the determination of the radiation scattering due to the walls, ceiling and floor of the Calibration Laboratory. The radiation detection was made with a portable ionization chamber Victoreen model Panoramic 470. The measurements were taken with and without the use of a lead shield block between the detector and the radioactive source. The results showed that the scattering contribution increased about 80%, as the distance between detector and source was varied from 1,0 to 2,0 m. Therefore the scattering contribution determination is very important for the establishment of the standard radiation fields for instruments calibration.

11670 (KIYI—87-11) Automatic γ-spectrometer for the determination of specific concentration of radionuclides in environmental objects. Vishnevskij, I.N.; Zerkin, V.V.; Kumshaev, S.B.; Lobach, Yu.N.; Sidorenko, V.A.; Tkachuk, I.P.; Trishin, V.V.; Churakov, A.K. (AN Ukrainskoj SSR, Kiev. Inst. Yadernykh Issledovanij). 1987. 23p. (In Russian). NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705311/JAW.

An automatic semiconductor γ-spectrometer is described on the base of micro-computer "Electronics NMC 11100.1" made for the determination of specific radionuclides in environmental objects. The stage of radioelement analysis and its software are discussed. 5 refs.; 3 figs.; 5 tabs.

11671 (KURRI-TR—291) Proceedings of the 3rd specialist research meeting on measurements of short-lived isotopes. Yoshizawa, Yasukazu; Kawase, Yoichi; Okano, Kotoyuki (eds.). (Kyoto Univ., Kumatori, Osaka (Japan). Research Reactor Inst.). Apr 1987. 6-11p. (In Japanese). (CONF-8612156—). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88780145/JAW.

From 3. specialist research meeting on measurements of short-lived isotopes; Kumatori, Japan (17 Dec 1986).

The individual papers in these proceedings have been abstracted and indexed separately.

11672 **(LA-UR—88-3919) The MEGA [Muon decays into an Electron and a GAmma ray] hardware trigger system.** Szymanski, J.J.; Amann, J.F.; Black, J.K.; Cooper, M.D.; Wright, S.C.; Crocker, J.; Sanders, H. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 6p. (CONF-8811125—2). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89003586/JAW.

From Rare decay symposium; Vancouver, Canada (30 Nov 1988).

The MEGA experiment is designed to search for the rare decay $\mu \rightarrow e\ \gamma$ with a branching ratio sensitivity of {approximately}10^{-13}. As is typical of rare-decay experiments, extensive, online filtering of the data is required for MEGA. The MEGA experiment uses a hardware pattern-recognition system based on Programmable Array Logic (PAL) devices. Additional events are eliminated in an online ACP system before data are written to tape. The MEGA trigger system is generally applicable where high-rate, short-propagation-delay trigger systems are required. This report contains an introduction to the MEGA experiment, a discussion of the MEGA hardware trigger system and a discussion of the system's measured performance. 4 refs., 3 figs.

11673 **(LAPP-T—88-01) Contribution to the elaboration and implementation of LEP-L3 second level microcoded Trigger.** Chollet, F. (Grenoble-1 Univ., 74 - Annecy (France). Lab. de Physique des Particules). Mar 1988. 222p. (In French). NTIS (US Sales Only), PC A10/MF A01. Order Number DE88756260/JAW.

This thesis is devoted to the elaboration of the L3 second level trigger which is based on the dedicated programmable XOP processor. This system will reduce the trigger rate by a factor of ten and will ensure that the hardwired level-one processors function correctly. The present document describes all developments that L.A.P.P. is engaged in from the system design up to the complete experimental set up, especially: - The hardware development of the fast input memories as well as the FASTBUS interface unit which allows the microprocessor XOP to run as a performant FASTBUS Master, - the associated software developments, - the implementation of a VME test system dedicated to all control tasks.

11674 **(MPI-PAE/Exp.El.—191) Use of the time projection chamber for measuring heavy ion collisions.** Settles, R. (Max-Planck-Institut fuer Physik und Astrophysik, Muenchen (Germany, F.R.). Werner-Heisenberg-Inst. fuer Physik). Jun 1988. 12p. (CONF-880280—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756394/JAW.

From International conference on physics and astrophysics of quark-gluon plasma; Bombay, India (8 Feb 1988).

The status of using time projection chambers as the central tracking detector for heavy-ion collision experiments is reviewed.

11675 **(ORNL/TM—10903) Theoretical studies of hadronic calorimetry for high luminosity, high energy colliders.** Brau, J.E.; Gabriel, T.A. (Oak Ridge National Lab., TN (USA)). Jan 1989. Contract AC05-84OR21400. 50p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005689/JAW.

Experiments at the high luminosity, high energy colliders of the future are going to demand optimization of the state of the art of calorimetry design and construction. During the past few years, the understanding of the basic phenomenology of hadron calorimeters has advanced through paralleled theoretical and experimental investigations. The important underlying processes are reviewed to set the framework for the presentation of recent calculations of the expected performance of silicon detector based hadron calorimeters. Such devices employing uranium are expected to achieve the compensation condition (that is, e/h ~ 1.0) based on the understanding that has been derived from the uranium-liquid argon and uranium-plastic scintillator systems. In fact, even lead-silicon calorimeters are found to achieve the attractive value for the e/h ratio of 1.16 at 10 GeV. 62 refs., 22 figs., 3 tabs.

11676 **(ORNL/TM—11030) Feasibility study and developmental efforts for an optical detector for neutron dosimetry: Progress report.** Hunter, S.R.; Turner, J.E.; Gibson, W.A. (Oak Ridge National Lab., TN (USA)). Jan 1989. Contract AC05-84OR21400. 65p. NTIS, PC A04/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005695/JAW.

This report describes the progress that we have made during the period from the commencement of this study (June 28, 1988) up to October 31, 1988. During this period, we have successfully completed the first two milestones for this project. These were to fabricate and construct a simple ionization chamber, an associated vacuum system and to develop a pulsed rf high voltage source to excite the electrons in the particle track and to be used to test the optical detection technique. The observation and photographing of ionizing particle tracks in a gas was to constitute the successful completion of this milestone. The second milestone consisted of evaluating the performance of this simple detector as a guide to the design of a final version, in terms of the operating gas pressures and mixture composition used to optimize the light output, and the rf voltage pulse amplitude, frequency and duration to achieve optimal spatial resolution. This progress report which outlines our observations constitutes the successful completion of this milestone. 9 refs., 7 figs.

11677 **(PNL-SA—15928) An automated beta irradiator.** Fox, R.A.; Leonowich, J.A.; Cummings, F.M. (Pacific Northwest Lab., Richland, WA (USA)). Sep 1988. Contract AC06-76RL01830. 6p. (CONF-881232—14). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005154/JAW.

From 22. health physics midyear topical meeting on instrumentation; San Antonio, TX, USA (4 Dec 1988).

To support the continuing effort of the US Department of Energy to maintain high-quality radiological calibrations, the Pacific Northwest Laboratory fabricated an automated beta irradiation system. The system hardware includes a microprocessor that controls the duration of the irradiation and records the input from environmental gauges that measure temperature, humidity, and barometric pressure. A bar-code reader is used to identify dosimeters. A thin-walled ionization chamber is mounted in the irradiation phantom, and its output is measured by a digital electrometer. Both the electrometer and the bar-code reader interface to the microprocessor. Alternating current power for the microprocessor is provided by an uninterruptible power supply. The system software collects the data necessary to perform the irradiation. This includes the source identification number, the delivered dose, and the dosimeter identification number. It also calculates their radiation duration time and generates the signals to open and close the source shutter. The operator is led through a series of parameter verifications and a printout summarizes all of the pertinent data. This paper describes the system in detail. 2 refs., 1 tab.

11678 **(PTB-Dos—16) Measuring instruments of the Physikalisch-Technische Bundesanstalt for realization of the units of the dosimetric quantities standard ion dose, photon-equivalent dose and air-kerma.** Engelke, B.A.; Oetzmann, W.; Struppek, G. (Physikalisch-Technische Bundesanstalt, Braunschweig (Germany, F.R.). Dosimetrie). Aug 1988. 119p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88756395/JAW.

The realization of the units of the dosimetric quantities exposure, air-kerma and photon-equivalent dose is an important task of the Physikalisch-Technische Bundesanstalt. The report describes the measuring instruments and other technical equipment as well as the determination of the numerous corrections needed. All data and correction factors required for the realization of the units mentioned above are given in many diagrams and tables.

11679 **(UCRL—53892) SANDYL calculations of the energy deposited in the EG&G TL-35 shielded thermoluminescent detector for photons from 0.1 to 18 MeV.** Goosman, D.R. (Lawrence Livermore National Lab., CA (USA)). 1 Nov 1988. Contract W-7405-ENG-48. 8p. NTIS, PC A02/MF A01 - OSTI. Order Number DE89005309/JAW.

The SANDYL electron-photon Monte Carlo code has been used to calculate the energy deposited in the CaF_2 core of a cylindrically shaped, shielded EG&G TL-35 thermoluminescent detector by photons between 0.1 and 18 MeV. The cylindrical axis of the detector shield pointed to a point source of photons 1 m away. 3 refs., 3 figs., 4 tabs.

11680 **Langmuir trough dedicated for x-ray study of monolayer systems.** Yun, W.B.; Bloch, J.M. (Argonne National Laboratory, Material Science Division, Building 223, 9700 S. Cass Avenue, Argonne, Illinois 60439). *Review of Scientific Instruments;* 60: No. 2, 214-218(Feb 1989).

Recently, several x-ray techniques have been demonstrated to have unique capabilities of making microscopic measurement on a monolayer supported on a liquid subphase. Substantial information about the phase transitions and chemical reactions of the monolayer system previously unavailable has been obtained. In this paper a Langmuir trough designed to perform these x-ray experiments is described. Design considerations specific for the x-ray applications are discussed, and the hardware implementation is described. The trough has been used successfully in our monolayer study using surface extended x-ray absorption fine structure (SEXAFS) and near total external fluorescence (NTEF) techniques.

11681 **Low-noise techniques in detectors.** Radeka, V. (Brookhaven National Laboratory, Upton, New York 11973). *Annual Review of Nuclear Science;* 38: No. 1, 217-278(1988).

We concentrate in this review on the fundamentals of low-noise techniques and on understanding the limits in the charge signal measurements. Charge collection and signal formation in detectors, the origin and properties of noise, noise and amplification of charge, and detectors and signal processing are discussed. (AIP)

4402 Radiation Effects On Instrument Components, Instruments, Or Electronic Systems

REFER ALSO TO CITATION(S) 11401

4403 Miscellaneous Instruments

REFER ALSO TO CITATION(S) 10964, 12135, 12470

11682 **(CONF-8802127—2) Two dimensional CCD [charged coupled device] arrays as parallel detectors in electron energy loss and x-ray wavelength dispersive spectroscopy.** Zaluzec, N.J. (Argonne National Lab., IL (USA)). Aug 1988. Contract W-31109-ENG-38. 12p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89003653/JAW.

From Workshop on electron-beam induced spectroscopies at very high spatial resolution; Aussois, France (29 Feb 1988).

Parallel detection systems for spectroscopy have generally been based upon linear detector arrays. Replacing the linear arrays with two dimensional systems yields more complicated devices; however, there are corresponding benefits which can be realized for both x-ray and electron energy loss spectroscopy. The operational design of these systems, as well as preliminary results from the construction of such a device used for electron spectroscopy, are presented. 10 refs., 8 figs.

11683 **(CONF-8810133—5) Screening environmental pollutants and biomarkers: The analytical challenge.** Vo-Dinh, Tuan. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 12p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89004931/JAW.

From 1. international symposium on field screening methods for hazardous waste site investigations; Las Vegas, NV, USA (11 Oct 1988).

Detailed characterization of most chemical pollutants in environmental samples from industrial and waste sites is possible using analytical techniques such as liquid or gas chromatography and mass spectroscopy. But for many environmental monitoring programs and assessment applications, these analytical procedures would be needlessly time-consuming and expensive. It is often desirable to have a screening procedure to prioritize environmental samples before detailed analyses are conducted on a subset of samples to reduce the total cost of monitoring programs and environmental studies. This presentation describes various screening techniques, such as synchronous fluorescence (SF), and room temperature phosphorescence (RTP), and provides an overview of advanced analytical techniques and instrumentation, such as surface-enhanced Raman scattering (SERS) and antibody-based fiberoptics sensors, used to detect trace levels of chemical pollutants and related biomarkers in complex environmental samples. 28 refs., 6 figs.

11684 **(LA—11408-MS) The design and characterization of a prototype optical heat-flux gauge.** Turley, W.D.; Borella, H.M.; Noel, B.W.; Beasley, A.; Sartory, W.K.; Cates, M.R. (Los Alamos National Lab., NM (USA)). Jan 1989. Contract W-7405-ENG-36. 12p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005523/JAW.

We have demonstrated the feasibility of using thermographic phosphors as the temperature sensors in an optical surface-heat-flux gauge. A heat flux of 40 kW/m^2 was measured with a gauge constructed by depositing La_2O_2S:Eu and Gd_2O_2S:Tb phosphors on the two faces of a polymethylpentene insulator. In the experiment, we measured a steady-state heat flux at a single point on a stationary surface; however, the gauge is also intended to measure transient heat flow. The technique is conceptually expandable to a two-dimensional temperature measurement. 17 refs., 10 figs., 1 tab.

11685 **(NBL—320) Automation of the New Brunswick Laboratory controlled-potential coulometric method for plutonium.** Mitchell, W.G.; Troutman, D.; Lewis, K. (USDOE New Brunswick Lab., Argonne, IL). Nov 1988. 57p. NTIS, PC A04/MF A01 - OSTI. Order Number DE89005150/JAW.

The development and evolution of the automated coulometric analysis of plutonium at the New Brunswick Laboratory is described. The importance of maintaining electrical calibration of the analysis so that the results are traceable to the Faraday is discussed. The innovations which were necessary to achieve the desired accuracy and precision are explained. The experimental tests to qualify the instruments for use in sample analysis at New Brunswick Laboratory are detailed. Details of the calculations performed by the automated coulometer system are given in the Appendix. 21 refs., 16 figs., 4 tabs.

11686 **(PNL-SA—15923) The proposed ANSI rf/microwave standard and the instrumentation available to perform compliance measurements.** Leonowich, J.A.; Johnson, R.E. (Pacific Northwest Lab., Richland, WA (USA)). Dec 1988. Contract AC06-76RL01830. 8p. (CONF-881232—10). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005203/JAW.

From 22. health physics midyear topical meeting on instrumentation; San Antonio, TX, USA (4 Dec 1988).

This paper will explore the various instrumentation that has been available in the past and its relevance to the proposed ANSI standard, along with new available instruments that may significantly modify the way compliance measurements are to be performed. A sample of the changes that may occur includes high frequency (hf) monitoring where previous electric or magnetic field levels must be converted in order to add fractions of each field component to determine if allowable levels of electromagnetic energy are exceeded. The paper will also cover spatial and time-averaged surveys and required instrument characteristics for properly measuring field levels down to the 3 to 10 kHz frequency range. Unwanted characteristics of instruments will be covered, such as magnetic field out-of-band responses, modulation errors, and other measurement phenomena associated with the various methods of detecting non-ionizing radiation. Special attention will be devoted to the calibration of the monitors, the various methods of calibration available, and applicability to a particular frequency range. 4 refs., 2 figs., 1 tab.

11687 **(UCRL—99408) The development and application of a short range, real-time active imaging system.** Kulp, T.J.; Kennedy, R.; Garvis, D.; McRae, T.G. (Lawrence Livermore National Lab., CA (USA)). Nov 1988. Contract W-7405-ENG-48. 14p. (CONF-8810267—1). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004020/JAW.

From Conference session on thermal and infrared sensing; Santa Ana, CA, USA (30 Oct 1988).

A laser active-imaging system capable of producing real-time, standard (RS-170) TV images was developed. The system consists of a modified flying-spot infrared imager that scans the instantaneous-field-of-view of a single detector in synchrony with the output beam of a continuous-wave laser. The imager has been modified for application to the problems of gas-plume imaging and underwater imaging. 14 refs., 5 figs.

11688 **(UCRL—99980) Explosion of integrated optic devices used in new generation systems.** Roeske, F. (Lawrence Livermore National Lab., CA (USA)). 15 Nov 1988. Contract W-7405-ENG-48. 4p. (CONF-881247—1). NTIS, PC A02/MF A01 - OSTI. Order Number DE89004012/JAW.

From Military fibre optic conference '88; Los Angeles, CA, United States (5 Dec 1988).

Integrated optics, indeed shows great promise for improving the quality and quantity of data needed in nuclear test diagnostics systems and other military systems. The systems described will give the testing program better than an order of magnitude increase in temporal response and dynamic range over the presently used counterparts, while also making it possible to increase the number of data channels by greater than an order of magnitude. Should these expectations reach fruition we should see a true explosion in the use of these devices in the near future. 3 refs., 5 figs.

11689 **Enrichment depth profiles in polymer blends measured by forward recoil spectrometry.** Sokolov, J.; Rafailovich, M.H.; Jones, R.A.L.; Kramer, E.J. (Department of Applied Science, Brookhaven National Laboratory, Upton, New York 11973). *Applied Physics Letters;* **54**: No. 6, 590-592(6 Feb 1989).

A novel time-of-flight detector system for He^+ forward recoil spectrometry which improves the depth resolution to better than 35 nm has been used to investigate the form of the surface enrichment profile in a protonated (normal) polystyrene (PS)/deuterated polystyrene (d-PS) blend. The volume fraction phi of d-PS depends on the depth z as phi(z) = phi/sub ∞/+(phi$_1$-phi/sub ∞/) exp(-z/ξ), where phi$_1$ and phi/sub ∞/ are the surface and bulk volume fractions of d-PS, respectively, and ξ is approximately the bulk correlation length, as predicted by theory.

11690 **Pressure cell for magnetostrictive measurements.** Ostenson, J.E.; Finnemore, D.K.; Jiles, D.C. (Ames Laboratory-USDOE and Department of Physics, Iowa State University, Ames, Iowa 50011). *Review of Scientific Instruments;* **60**: No. 2, 278-280(Feb 1989).

A pressure cell has been designed to study the magnetostrictive properties of a material as a function of both pressure and magnetic field. For changes in length on the order of 2000 ppm, it is necessary to have a substantial compliance in the pressure cell to retain a constant stress over the length of travel.

11691 **Analysis and assessment of electromagnetic ring expansion as a high-strain-rate test.** Gourdin, W.H. (Lawrence Livermore National Laboratory, University of California, Livermore, California 94550). *Journal of Applied Physics;* **65**: No. 2, 411-422(15 Jan 1989).

The rapid expansion of electromagnetically launched thin metal rings is analyzed in detail, with particular emphasis on the determination of the expansion speed, currents, and specimen temperature as a function of launch voltage. Electrodynamic calculations for copper, tin, and lead rings are presented and compared with typical experimental results. Currents derived from Rogowski-probe records and expansion speeds measured with a velocity interferometer (VISAR) are found to be in excellent agreement with these calculations. Currents are large, of the order of tens of kiloamperes, and heating of the specimen can be significant. It is found that, for good conductors such as copper, the maximum useful strain rate will be limited by the Joule heating of the specimen. For materials with resistivities and strengths substantially larger than those of copper, direct expansion of a specimen ring is difficult. Use of a composite ring, in which a high-conductivity driver is used to launch a low-conductivity specimen, is discussed as a means of overcoming this limitation.

4404 Well Logging Instrumentation

REFER ALSO TO CITATION(S) 10684, 11593

45 EXPLOSIONS AND EXPLOSIVES

4501 Chemical

REFER ALSO TO CITATION(S) 11420

11692 **(CNIC—00103) Experimental studies on the combined detonation profile in an explosive slab initiated at multiple points.** Yan Guoqing. (Southwest Inst. of Fluid Physics, Chengdu, SC (China)). (China Nuclear Information Centre, Beijing, BJ). Nov 1987. 7p. (In Chinese). (SIFP—0001). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704099/JAW.

The experimental observation of the combined detonation profile at the end of explosive slab of TNT/RDX (40/60) is described in detail. The explosive charge was initiated at multiple points on the surface of its beginning end. It is shown by the observation that the combined detonation profiles eventually approach to a constant shape under certain conditions. In the experiment with an attenuator inserted into the charge, it is found that the attenuators of some materials have considerable effects on the combined detonation profiles, but some have none. With attenuators of same materials, their effects depend on the states of the combined detonation profiles to some extent. The effects of the Mach reflection on the combined detonation profiles are also discussed here.

11693 **(LA—11414-MS) Measurements of detonation-wave spreading and local particle velocity at the surface of 17-mm LX-07 hemispherical boosters.** Dallman, J.C. (Los Alamos National Lab., NM (USA)). Dec 1988. Contract W-7405-ENG-36. 43p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89003449/JAW.

The performance of the 17-mm hemispherical LX-07 explosive booster pellet is examined. Measurements are presented of the excess transit time, the emergence angle of the detonation wave, the velocity of an interface between the surface of the hemispherical pellet and a PMMA window at angles from 0{degree} to 76{degree} from the pole. Measurements are also presented, for a limited number of cases, of the shock velocities in the PMMA window that provide corroborative information about the detonation wave emergence angle. 9 refs., 16 figs., 1 tab.

11694 **(LA-UR—88-3996) Prediction and synthesis efforts at Los Alamos.** Stine, J.R.; Coburn, M.D. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 17p. (CONF-8806277—1). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89003605/JAW.

From 7. annual working group meeting on synthesis of high energy density materials; Parsippany, NJ, USA (1 Jun 1988).

One important aspect of an organic synthesis effort related to the development of new explosives, is the ability to estimate the properties of proposed molecules. In most cases, the detonation velocity and C-J pressure are estimated for the proposed explosive using any number of existing predictive methods. Novel explosives are being proposed, at Los Alamos and elsewhere, that are qualitatively different in their molecular makeup than most of the existing conventional ones. These explosives include, highly strained cage molecules, heterocyclic molecules, low hydrogen-containing molecules, and high nitrogen-containing molecules. This paper describes alternate ways of viewing detonation velocities and a new method

for estimating detonation velocity of a proposed compound. 10 refs., 2 figs., 4 tabs.

11695 **(SAND—88-0621) Explosive output characteristics of mild detonating fuse.** Jungst, R.G.; Hallett, S.G.; Wickstrom, R.D. (Sandia National Labs., Albuquerque, NM (USA)). Jan 1989. Contract AC04-76DP00789. 28p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005504/JAW.

VISAR measurements of particle velocities in aluminized polymethylmethacrylate (PMMA) windows have been used to study the amplitude and width of pressure pulses generated by the function of mild detonating fuse (MDF). Samples tested included several different core loads of hexanitrostilbene (HNS) or hexanitroazobenzene (HNAB) in an aluminum sheath and pentaerythritol tetranitrate (PETN) in a lead sheath. Explosive density was found to be the major factor determining the peak pressure transferred to the window. Explosive core diameter primarily affected the width of the pressure pulse. However, some evidence for a small diameter effect on peak pressure was also noted. Geometry-related structure on the pressure pulse appeared consistently and contributed to the overall pulse width, especially for small diameter explosive columns. Two grain per food core loads of hydrocompacted HNS and HNAB MDF are of interest for component applications. These two materials contain similar explosive densities and it was found that both generate nearly the same peak pressure in PMMA. 8 refs., 8 figs., 4 tabs.

11696 **(SAND—88-2338) Explosive shaped charge penetration into tuff rock.** Vigil, M.G. (Sandia National Labs., Albuquerque, NM (USA)). Oct 1988. Contract AC04-76DP00789. 69p. NTIS, PC A04/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004664/JAW.

Analysis and data for the use of Explosive Shaped Charges (ESC) to generate holes in tuff rock formation is presented. The ESCs evaluated include Conical Shaped Charges (CSC) and Explosive Formed Projectiles (EFP). The CSCs vary in size from 0.158 to 9.1 inches inside cone diameter. The EFPs were 5.0 inches in diameter. Data for projectile impact angles of 30 and 90 degrees are presented. Analytically predicted depth of penetration data generally compared favorably with experimental data. Predicted depth of penetration versus ESC standoff data and hole profile dimensions in tuff are also presented. 24 refs., 45 figs., 6 tabs.

11697 **Approach to the steady solution for a plane Chapman--Jouguet detonation.** Fickett, W. (Los Alamos National Laboratory, Group M-9, Mail Stop P952, P.O. Box 1663, Los Alamos, New Mexico 87544). *Physics of Fluids A: Fluid Dynamics;* **1**: No. 2, 371-379(Feb 1989).

In the context of the author's mathematical analog for reactive flow, the late-time approach to the steady solution for a plane Chapman--Jouguet (CJ) detonation is studied. The reaction kinetics are those of the "small resolved heat release" model, in which the bulk of the chemical energy is released instantaneously in the shock and the remainder is released at a finite rate in the following reaction zone. Calculated shock histories and particle histories (Lagrangian gauge records) are presented for two driver prescriptions that initiate the detonation close to the steady solution. The implications of these results for the interpretation of CJ pressure measurements is discussed.

4502 Nuclear

REFER ALSO TO CITATION(S) 11181, 11443, 11592, 11688

11698 **(PB—89-850119/XAB) Electromagnetic pulse (EMP): phenomena, simulation, and hardening. November 1986-October 1988 (Citations from the INSPEC: Information Services for the Physics and Engineering Communities data base). Report for November 1986-October 1988.** (National Technical Information Service, Springfield, VA (USA)). Nov 1988. 84p. NTIS PC N01/MF N01.

Supersedes PB—87-869202.

This bibliography contains citations concerning natural and nuclear electromagentic pulse (EMP) phenomena. Analyses and simulations of EMP interactions and coupling with various susceptible objects and devices and their responses are presented. Protective methods and technology are also considered along with test techniques and results. Attention is also given to computer aided EMP analysis. (This updated bibliography contains 155 citations, 93 of which are new entries to the previous edition.)

11699 **(UCRL—100025) The future of nuclear weapon technology.** Miller, G.H.; Brown, P.S.; Herman, P.T.; Neifert, R.D.; Chrzanowski, P.L. (Lawrence Livermore National Lab., CA (USA)). Nov 1988. Contract W-7405-ENG-48. 24p. (CONF-8806206—1). NTIS, PC A03/MF A01 - OSTI. Order Number DE89004808/JAW.

From Conference on the future of nuclear weapons: the next three decades; Los Alamos, NM, USA (6 Jun 1988).

The next few years will bring decisions that are critical for the future of the nation's nuclear weapons program and for the role of the national weapons laboratories. To meet this challenge, the United States needs to develop both a clear, cohesive, national-security strategy and a policy regarding the future role of nuclear weapons that are appropriate to rapidly evolving political and technical environments. The current weapons debate has been complicated by the controversy over the future of strategic defenses and by uncertainty over the role to be played by conventional forces and armaments. Other uncertainties have been introduced by nonmilitary security issues such as energy policy and the declining economic position of the United States with respect to other nations. Major national fiscal problems have placed severe constraints on defense spending. The nuclear weapons program itself suffers from a fragile and aging production and R&D complex, which has been further subjected to increasing demands arising from environmental, safety, and security concerns. Problems leading to shutdowns and power reductions in the DOE production reactors typify the situation, but concerns are even more widespread than those involving the reactors, both in the Nuclear Weapons Complex (NWC) and in the country as a whole. This paper will discuss what this means to the future of nuclear weapons technology. 1 fig., 1 tab.

50 ENVIRONMENTAL SCIENCES, ATMOSPHERIC

5001 Basic Studies

REFER ALSO TO CITATION(S) 11161, 11618, 11712, 11713, 11725, 11734, 11735, 11891

11700 **(BONN-IR—88-19) Investigations of large scale and small scale dynamic processes in the mesosphere and upper stratosphere derived from wind and density measurements over Northern Skandinavia within the MAP/WINE project.** Meyer, W. (Bonn Univ. (Germany, F.R.). Physikalisches Inst.; Bonn Univ. (Germany, F.R.). Mathematisch-Naturwissenschaftliche Fakultaet). May 1988. 94p. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88756190/JAW.

First the measuring methods for wind, density and temperature by means of rockets, falling balls and probes are described. Anemometry was combined with remote sensing methods and in-situ measurements for investigating dynamic processes. A good agreement up to an altitude of 60 km was the result of a comparison with geotrophic winds from satellite data. Short-term and medium-term variations become visible in addition to long-term variations in the wind field caused by planetary waves. The variability over a time of < 6 h is used as a measure for the average amplitude of gravitational waves. Moreover the vertical structure of the horizontal winds and the vertical winds were investigated on the basis of average vertical wavelength spectrums from measurements with Chaff and SONSY-MST radar.

11701 **(GSF-BPT—1/88) Comparative assessment of various instruments for atmospheric ozone monitoring and trend analysis. Final report.** Koehler, U.; Wege, K.; Hartmannsgruber, R.; Claude, H. (Deutscher Wetterdienst, Hohenpeissenberg (Germany, F.R.). Meteorologisches Observatorium). (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H. Muenchen, Neuherberg (Germany, F.R.). Bereich Projekttraegerschaften; Deutscher Wetterdienst, Hohenspeissenberg (Germany, F.R.). Meteorologisches Observatorium). 1988. 127p. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88756192/JAW.

A number of established and new measuring instruments and methods are available today for the monitoring of atmospheric ozone. The Dobson spectrophotometer which has been used for decades for total ozone measurement has been complemented in the last years by a transportable spectrophotometer, the so-called Brewer, equipped with modern electronics and computed control. Detailed comparisons were made with both instruments which are thoroughly explained in this article. The balloon sonde Brewer/Mast having been used for 20 years on the Hohenpeissenberg for ozone measuring delivers ozone data only up to a height of approximately 35 km. For this reason, a chemiluminescence probe developed at the Institute for Physical Chemistry of the University of Bonn, which is also suitable for measurements at higher altitudes, was adapted to the probing system of the observatory and tested. Series of measurements over many years point out a decreasing ozone trend in the stratosphere and show a significant ozone increase in the troposhpere.

11702 **(NP—9770184) Simulations of thermally induced winds and cross flow.** Ulrich, W. (Muenchen Univ. (Germany, F.R.). Meteorologisches Inst.). Feb 1987. 204p. (In German). NTIS (US Sales Only), PC A10/MF A01. Order Number DE89770184/JAW.

Primary emphasis is placed on the development and testing of a three-dimensional instationary mesoscale simulation model which allows to simulate local wind systems as they result from cross flow or thermal excitation in the case of steep topography. The usual transformations of coordinates of the motion equations in a system adapted to the topography are unsuitable under such conditions. The topography also is to be resolved more exactly than it is by a terraced structure. This is achieved by understanding the system of air and topography as a two-liquid problem. In this connection the air is a medium of a viscosity which can nearly be neglected and the topography is an area of infinitely high viscosity (Mason and Sykes 1978a). In the development of the model it was taken care to keep the numerical methods which are used for the integration of the motion equations as clear and transparent as possible. The consistent energy and mass conservation is in the establishment in the preparation of the (difference) equations. Parametrizations were avoided as far as possible. The selection of individual problems as the investigation and development of suitable peripheral conditions and the efficiency test of the turbulence parametrizations of the model takes up much space. Examples for the application of the 3D model are the simulation of thermally induced circulations in the Dischma valley (near Davos), and canalization effects in the Loisach valley and the Inn valley.

11703 **(NP—9770187) Flue gas dispersion under the condition of fumigation.** Timm, B.; Stern, R. (Senator fuer Stadtenwicklung und Umweltschutz, Berlin (Germany, F.R.)). 1985. 52p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE89770187/JAW.

It is tried to parameterize the phenomenon of fumigation in the framework of the stationary theory of Gauss. Dispersion calculations for selected case examples with such an approach are compared with calculations without consideration of fumigation and with calculations based on a numerical solution of the diffusion equation. The report gives a survey on the most important activities carried out in the framework of this study.

11704 **(NP—9770189) Experimental and numerical investigations of the slope wind layer and its role in the warming of valleys.** Brehm, M. (Muenchen Univ. (Germany, F.R.). Meteorologisches Inst.). Oct 1986. 181p. (In German). NTIS (US Sales Only), PC A09/MF A01. Order Number DE89770189/JAW.

Main emphasis is placed on the evaluation of the Innsbruck anabatic wind experiment. It becomes obvious that a great deal of the warming in valleys is due to sinking processes and that the valley atmosphere is warmed throughout its total height. The sinking processes in the valley atmosphere result from the anabatic winds, because the anabatic volume flow causes a compensating sinking at any height of the valley atmosphere. The heat transfer which occurs can be described by means of a conceptional model by Vergeiner (1982). A one-dimensional numeric model is presented by which the wind, temperature and exchange conditions in the anabatic wind flow can be calculated. An analogous form of the law of resistance and a connection between temperature and mass transfer in the anabatic wind flow is derived from the model results. Thus it is possible to describe the heat transfer along a slope and in the valley atmosphere with a simple energetic box model. The numeric simulations carried out by this model show the influence of the valley geometry, the thermal flow and the morning temperature profile on the warming up processes and the dissolution of stable layers in valleys.

11705 **Urbanization: Its detection and effect in the United States climate record.** Karl, T.R.; Diaz, H.F.; Kukla, G. (National Climatic Data Center, NOAA, Asheville, North Carolina). *Journal of Climate;* 1: No. 11, 1099-1123(Nov 1988).

Several equations were developed that related the effect of urban growth, measured by increasing population, to the mean seasonal and annual temperature: the diurnal maximum, minimum, average, and range. These equations were derived from a network of 1219 stations across the United States, which were analyzed for the years 1901--84. The results indicate that urban effects on temperature are detectable even for small towns with populations under 10 000. Stations with populations near 10 000 are shown to average 0.1 °C warmer for the mean annual temperature than nearby stations located in rural areas with populations less than 2000. Urbanization decreases the daily maxima in all seasons except winter and the temperature range in all seasons. It increases the diurnal minima and the daily means in all seasons.

5002 Chemicals Monitoring And Transport

REFER ALSO TO CITATION(S) 10646, 10659, 10660, 10785, 10867, 10870, 11178, 11241, 11254, 11302, 11309, 11482, 11598, 11612, 11703, 11838, 11916, 11920, 11928, 11932, 11946

11706 **(BNL—41951) Reactive scavenging in clouds.** Daum, P.H. (Brookhaven National Lab., Upton, NY (USA)). Oct 1988. Contract AC02-76CH00016. 3p. (CONF-890134—2). NTIS, PC A02/MF A01 - OSTI. Order Number DE89004535/JAW.

From Symposium on the role of clouds in atmospheric chemistry and global climate; Anaheim, CA, USA (29 Jan 1989).

Since field evidence suggests rapid and quantitative in-cloud oxidation of SO_2 to SO_4 to the extent limited by the availability of H_2O_2, it is important to assess H_2O_2 and SO_2 concentration fields under pertinent sets of conditions. We discuss here the concentrations of these and related species measured during the PRECP-V field program conducted in Central Ohio during June, 1987. These measurements document the concentration fields of these two species under midwestern summertime conditions, and extends examination of SO_2/H_2O_2 relationships to clear-air conditions. 8 refs., 4 figs.

11707 **(CONF-8804148—5) Simulating the physiological basis of tree ring responses to environmental changes.** Luxmoore, R.J.; Tharp, M.L.; West, D.C. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 22p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89004168/JAW.

From Conference on forest growth: process modeling of responses to environmental stress; Gulf Shores, AL, USA (19 Apr 1988).

The detection of possible forest growth responses to changes in atmospheric CO_2 or air pollutants is very difficult by statistical analysis of tree ring chronologies, and a complementary modeling

approach has been initially tested. In this new approach, a linked set of mechanistic transport models of carbon, water, and chemical dynamics in soil-plant-litter systems (UTM) is used to generate a matrix of simulated annual stem-wood increment and winter carbon storage values for a range of degree day, water stress, and atmospheric CO_2 concentrations. These values represent potential tree growth responses as determined by hourly time-step physiological processes. The matrix is accessed by a forest succession model (FORET) according to selected degree day and water stress values or by use of actual site data. These potential growth responses are modified to realized annual increments according to the competition algorithms of the succession simulator using yearly time steps. A 12% increase in stem-wood production was predicted for an oak-hickory (Quercus-Carya spp.) forest in eastern Tennessee by the UTM for both a change in atmospheric CO_2 from 260 to 340 and from 340 to 600 μL/L.

11708 **(CONF-8809216—1) Temperature-oxygen habitat for freshwater and coastal striped bass in a changing climate.** Coutant, C.C. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 39p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005125/JAW.

From American Fisheries Society meeting; Toronto, Canada (12 Sep 1988).

Habitat space for a fish species is normally constrained by extreme temperatures and low dissolved oxygen concentrations that the fish avoid. Both latitudinal limits to a species' distribution over a large area and availability of suitable habitat on the local scale may be altered by climate change. Average temperatures are expected to rise globally, and rainfall is expected to decrease in middle and increase in high latitudes in the next century. This paper uses the anadromous and landlocked stocks of striped bass to illustrate the possible effects of climate change on fish distribution. The tenuous existence of striped bass along the northern coast of the Gulf of Mexico and in Florida will likely be jeopardized by regional warming and reduced streamflow in the rivers in which these fish reside. In many freshwater lakes, reservoirs, and estuaries, the existing summer constriction of suitable habitat by high temperatures and low oxygen concentrations may be aggravated by warming, altered streamflow, and increased hypoxia. An expansion of the species' range around Nova Scotia and in the Gulf of St. Lawrence may occur, although the cold Labrador Current may strengthen and cancel any potential water temperature increases. Our understanding of the habitat requirements of highly visible fish species exceeds our confidence in climate models, but will allow forecasts of changes in regional and local habitat suitability as climate understanding and forecasting improve. 45 refs., 7 figs.

11709 **(CONF-8809217—1) The potential application of models in forecasting the effects that climate changes have on fisheries.** DeAngelis, D.L.; Cushman, R.M. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 53p. NTIS, PC A04/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004794/JAW.

From Symposium on climate effects on fisheries; Toronto, Canada (12 Sep 1988).

Increased levels of carbon dioxide in the atmosphere and the possible resulting climatic changes will affect marine and freshwater fisheries. Many of the links in the causal chains relating these environmental changes to possible changes in fish stocks may be amenable to prediction through mathematical modeling. The adequacy of existing types of mathematical models relating changes in atmospheric CO_2 to changes in environmental conditions and ultimately to changes in fish stocks are reviewed in the context of an overall strategy for forecasting changes in fish stocks. The model types include ecosystem models, fish physiological process models, and fish population models. 96 refs., 5 figs., 2 tabs.

11710 **(DP-MS—88-152) A comparison of original aircraft MSS and generated surface water reflectance images as predictors of lake water quality indicators.** Ramsey, E.W. III; Jensen, J.R. (South Carolina Univ., Columbia (USA). Dept. of Geography). 1988. Contract AC09-76SR00001. 13p. (CONF-8809220—1). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004882/JAW.

From Fall technical meeting of the American Society of Photogrammetry and Remote Sensing; Virginia Beach, VA, USA (11 Sep 1988).

Generated reflectance and original MSS images were compared at six blue to near infrared wavelengths at thirty-eight (38) field locations in three different lakes. Both sets of images were evaluated in terms of their importance in explaining the variance of measured reflectances. Subsequently, the generated reflectance images were related to measured chlorophyll {und a} and total suspended solids using a statistical analysis that uncovered the simplest relationships explaining the greatest amount of each water variables variance. Applying this methodology resulted in predictor equations explaining 82% of the chlorophyll {und a} variance and 92% of the total suspended solids variance within the thirty-two (32) water samples analyzed. Maps were produced of L Lake depicting the distributions of two water quality indicators: chlorophyll a and total suspended particles. 16 refs., 6 figs., 4 tabs.

11711 **(EPRI-EA—6070) Interim emissions inventory for regional air quality studies.** Heisler, S.L.; Collins, H.; Collins, J.; Hayden, P.; Lurmann, F.; Yeransian, T.; Young, J. (Electric Power Research Inst., Palo Alto, CA (USA); ENSR Consulting and Engineering, Camarillo, CA (USA)). Nov 1988. 261p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI89004384/JAW.

An emissions inventory for 1982 has been developed for the contiguous United States and part of southeastern Canada. Inventoried materials include total emitted particulate matter (TEP), alkaline TEP, SO_2, SO_4/sup =/, NO, NO_2, NH_3, and hydrocarbons in nine reactivity classes. Emission rates, geographic locations, and stack parameters are provided for major TEP, SO_2, NO/sub x/, and HC emitters. Emission rates for all other sources are aggregated into 1/2{degree} longitude by 1/3{degree} latitude elements of a grid system. Emission rates were developed for several averaging times: the entire year, each season, weekdays and weekends within each season, and each of the eight 3-hour periods during weekdays and weekends in each season. 95 refs., 12 figs., 68 tabs.

11712 **(GSF-BPT—2/88) Investigation of the vertical distribution of long-lived stratospheric trace gases and their variation in time and space. Final report.** Schmidt, U. (comp.). (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Atmosphaerische Chemie). (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H. Muenchen, Neuherberg (Germany, F.R.). Bereich Projekttraegerschaften; Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Atmosphaerische Chemie). 1988. 124p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88756193/JAW.

A light, compact, neon-cooled air sampler was developed and constructed, which collects air up to 300 l in the stratosphere at different heights. For the first time it was possible to establish representative mean vertical profiles for the five most important (= most frequent) anthropogenic halogenated hydrocarbons for middle latitudes. The results show that the natural of chlorine concentration in the stratosphere has increased to five times the original value by the anthropogenic emission of these gases. The comparison of the mean profiles for summer and winter conditions clearly shows the differences in the stratospheric circulation. The large-scale depression over the Winter Pole can be observed in the northern hemisphere also over middle latitudes.

11713 **(GSF-BPT—4/88) Natural and anthropogenic source gases: Vertical and global distributions. Final report.** Fabian, P. (Max-Planck-Institut fuer Aeronomie, Katlenburg-Lindau (Germany, F.R.)). (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H. Muenchen, Neuherberg (Germany, F.R.). Bereich Projekttraegerschaften; Max-Planck-Institut fuer Aeronomie, Katlenburg-Lindau (Germany, F.R.)). 1988. 68p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88756194/JAW.

The project measure task to the vertical and global distribution of source gases in the atmosphere of the Northern hemisphere, i.e. natural and anthropogenic stable tracer gases of biospheric/tropospheric origin, whose photochemical degradation in the stratosphere is the source for radicals degrading ozone in catalytic

cycles. A balloonborne, cryogenic collector cooled with liquid neon is used with which large air samples can be frozen out at different heights of the stratosphere and troposphere up to nearly 40 km. The analysis of these air samples by means of gas chromatography (GC) takes place in the laboratory and allows the simultaneous measurement of the most important source gases, more than 20 at present, halogenated hydrocarbons et al. Complete vertical profiles of the source gases can be determined according to this method.

11714 **(IVL-B—860) Calculation of contributions from different sources to the air pollution in central Gothenburg.** Dahlberg, K.; Steen, B. (Swedish Environmental Research Inst., Goeteborg). May 1987. 37p. (In Swedish). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755772/JAW.

Existing techniques for source apportionments are reviewed and a new approach lined out. Source contributions are determined for urban air in central Gothenburg. Gaseous as well as particle-borne components are used in the same model to give more characteristic source signatures.

11715 **(LRAP—70) Comparison between different techniques for urban monitoring of NO/sub 2/.** Galle, B.; Sunesson, A.; Uneus, L.; Wallin, S.; Wendt, W. (Swedish Environmental Research Inst., Goeteborg (SE); Lund Inst. of Tech. (SE). Dept. of Phys.). (Lund Univ. (Sweden). Dept. of Physics). Oct 1986. 22p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755779/JAW.

In the past the monitoring of urban pollutants has been performed with point monitoring systems. One or several such systems are used to gather information on the pollutant situation. However, these systems are naturally sensitive to local variations of the pollutant, e.g. an emission plume may suddenly sweep over the system because of a wind change. Methods that are believed to give more representative information of the pollutants, include the doas (differential optical absorption spectroscopy) and lidar (light detection and ranging) techniques. Measurements of the NO/sub 2/ concentration in the air over a major city, during a period with varying concentrations of pollutants, have been performed. A point monitoring system, a path-integrating doas set-up and a lidar system capable of two-dimensional mapping were used for measuring the NO/sub 2/ concentration. A comparison between the systems is performed. (authors).

11716 **(NASA-CR—179225) Carbon Dioxide Observational Platform System (CO-OPS) feasibility study: Final report.** Bouquet, D.L.; Hall, D.W.; McElveen, R.P. (National Aeronautics and Space Administration, Huntsville, AL (USA). George C. Marshall Space Flight Center). Dec 1987. Contract AI05-82OR21004. 196p. NTIS, PC A10/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005231/JAW.

The Carbon Dioxide Observational Platform System (CO-OPS) is a near-space, geo-stationary, multi-user, unmanned microwave powered monitoring platform system. It could potentially operate continuously for periods of up to 3 months in quasi-fixed position over regional targets of interest and could make horizon observations over a land-sea area of circular diameter up to about 600 to 800 statute miles. This affords the scientific and engineering community a low-cost means of operating their payloads for monitoring the regional parameters they deem relevant to their investigations and operations at one-tenth the cost of most currently utilized comparable remote sensing techniques. This systems engineering feasibility study addressed clearly identified existing requirements such as the: (1) carbon dioxide observational data requirements, (2) communications requirements, and (3) eye-in-the-sky requirements of other groups like the Defense Department, the Forestry Service, and the Coast Guard. In addition, potential applications in: (1) Earth System Science, (2) Space System Sciences, and (3) Test and Verification (Satellite Sensors and Data Management Techniques) were considered. This report summarizes an eleven-month effort on the part of Lockheed-Georgia Company and its subcontractors Raytheon, Ball Aerospace and Sundstrand, to study feasibility of CO-OPS. Past work and methods of gathering the required observational data were assessed and rough-order-of magnitude cost estimates have shown the CO-OPS system to be most cost-effective (less than $30 million dollars with a 10-year life-time). This study team also concluded that there are no technical, schedule or cost obstacles that would prevent achieving the objectives of the total 5-year CO-OPS program. 40 refs., 76 figs., 49 tabs.

11717 **(NEI-DK—122) Effects of acid rain on the ion balance and leaching of metals and anions in Danish spruce forest ecosystems in the period 1983-1987.** Rasmussen, L. (Danmarks Tekniske Hoejskole, Lyngby. Lab. for Oekologi og Miljoelaere). Aug 1988. 79p. (In Danish). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88755803/JAW.

In 1983 the Laboratory of Environmental Sciences and Ecology, Technical University of Denmark, implemented field studies in three Norway spruce plantations (40-60 years old) in Denmark: Klosterhede at Lemvig western Jutland, Tange at Viborg central Jutland and the Stroedam-Reserve at Hilleroed northern Zealand. The aims were (1) to quantify the atmospheric deposition of cations and anions, (2) to determine the cycling of elements, the ion balance and the leaching from the root zone, and (3) to evaluate the influence of atmospheric deposition of airpollutants on the vitality of the forests. Air pollution contributes with 60% of the total acidification of the forests in relation to the natural and management acidifying proocesses. The study has shown in which way complex chemical and biological processes are affected by sulphur and nitrogen compounds. At the Klosterhede Plantation the low vitality of the forest can be ascribed to the chemical and microbiological conditions in the nutrient poor soil. The acidic atmospheric deposition cannot be neutralized by weathering of basic cations in the soil. Therefore toxic aluminium compounds are dissolved, which has a detrimental influence on tree roots. The influence of sea spray in this part of the country is also a stress factor for forest ecosystems. At the Stroedam-Reserve where the forests is unmanaged due to the nature reserve status, the low vitality of the forest can also be ascribed to an ion imbalance in the soil and poor chemical soil condition for root growth. At the Tange site the trees in the research plot are in good growth, but at the forest edge they keep dying. 31 refs. (AB).

11718 **(NILU-OR—8/86) Formation of oxidants in gas flare plumes in the North Sea.** Hov, Oe. (Norsk Inst. for Luftforskning, Lillestroem (Norway)). Jan 1986. 12p. (In Norwegian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755833/JAW.

Estimation of the emissions of non methane hydrocarbons (NMHC) and nitrogen oxides (NOx) from gas flares in the North Sea, gives an indication that the emissions are minor and little to worry about in the context of photochemical oxidants. The data base for the estimate is very weak, however, and a limited program for measurements of NMHC (including aldehydes) and NOx in a gas flare plume, is proposed in order to improve the emission estimates. 12 refs., 2 figs., 2 tabs.

11719 **(NLVF/S—723) Catalyst for the removal of hazardous effluents in flue gas. Final report.** Myrdal, R.; Oftedal, T.A. (Forsvarets Forskningsinstitutt, Kjeller (Norway)). (Norges Landbruksvitenskapelige Forskningsraad, Oslo). 3 Nov 1987. 11p. (In Norwegian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755836/JAW.

The report deals with a project on the testing and development of a suitable catalyst for the removal of hazardous pollutants and the decrease of NO/sub x/ in the flue gas from the combustion of charcoal. 2 drawings.

11720 **(NP—9770188) Air pollution in Baden-Wuerttemberg.** Kilchenmann, A.; Henning, K.; Gries, A. (Karlsruhe Univ. (T.H.) (Germany, F.R.). Geographisches Inst.). Aug 1987. 33p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE89770188/JAW.

The examination of time series of sulphur dioxide, nitric monoxide, nitrogen dioxide and ozone in Baden-Wuerttemberg show a regional and temporal distribution which is influenced by quite a lot of factors. The degree of pollutant concentration is closely related to human activities, such as traffic, industry and households. The spreading conditions depend, to a very large

extent, on wind direction, wind velocity and the turbulences. Although, in the case of sulphur dioxide immissions, there can be noticed a declining tendency in general, the average annual value of 1985 is somewhat higher than the year before. The SO/sub 2/ immissions show a distinct daily and annual course. An alarming development has been noticed for nitric oxide immission. The highest values for ozone immission are recorded in summer due to the dependence on insolation. The limit of 240 μg/m/sup 3/ (US limit value) is exceeded at nearly all stations. At three of the measuring stations the guide mark of 200 μg/m/sup 3/ is exceeded by more than 1% of the measured values. (orig./HSCH) With 7 separate maps.

11721 **(NP—9770196) Ozone measurements near the ground and in the atmosphere in the first half-year 1987.** (Deutscher Wetterdienst, Hohenspeissenberg (Germany, F.R.). Meteorologisches Observatorium). 1987. 187p. (In German). NTIS (US Sales Only), PC A09/MF A01. Order Number DE89770196/JAW.

Diagrams and tables, also for SO/sub 2/ in surface air.

11722 **(NP—9770197) Ozone measurements near the ground and in the atmosphere in the second half-year 1987.** (Deutscher Wetterdienst, Hohenspeissenberg (Germany, F.R.). Meteorologisches Observatorium). 1987. 173p. (In German). NTIS (US Sales Only), PC A08/MF A01. Order Number DE89770197/JAW.

Diagrams and tables, also for SO/sub 2/ in surface air.

11723 **(NP—9770201) Concentration measurements of Aitken nuclei in the stratosphere. Final report.** Neubauer, F.M.; Kaeselau, K.H. (Koeln Univ. (Germany, F.R.). Inst. fuer Geophysik und Meteorologie; Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). 1988. 41p. (In German). NTIS (US Sales Only), PC A03. Order Number DE89770201/JAW.

The research project was meant to be a supplementary contribution to current investigations on ion distribution and trace gas distribution. Topic of the investigation was the aerosol formation from the gas phase and the ion-induced aerosol formation. The vertical distribution of the Aitken nuclei concentration was measured during a balloon-borne campaign in Southern France. The thus obtained profile points to sources in the middle stratosphere. The results of this one profile cannot, however, be generalized. The development of a one-dimensional, time-dependent aerosol model has been started.

11724 **(NP—9770202) Research on the stratosphere ozone - an initial paper of the Federal Ministry of Research and Technoloy.** (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). 18 Jul 1988. 42p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE89770202/JAW.

In this paper on his own initiative the Federal Minister of Research and Technology reports on the present state and the future development of the German ozone research. After an introduction to the problem of the diminishing ozone concentration in the stratosphere, the present state of research is described on the basis of past projects. Guidelines for future coordination of German ozone research are proposed, which among other things envisage a concentration on the Northern hemisphere, improved observation and measurement with efficient instruments, intensification of modelling and lab experiments and also integration into international, above all European programmes. A small office is to take over coordination at European level.

11725 **(NP—9770205) Measurement of the global distribution of tropospheric trace gases and their time-dependent variations. Final report.** Scheel, H.E.; Slemr, F.; Matuska, P.; Werhahn, J.; Seiler, W. (Fraunhofer-Gesellschaft zur Foerderung der Angewandten Forschung e.V., Garmisch-Partenkirchen (Germany, F.R.). Inst. fuer Atmosphaerische Umweltforschung; Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). 1988. 216p. (In German). NTIS (US Sales Only), PC A10/MF A01. Order Number DE89770205/JAW.

A cargo container has been modified in accordance with air traffic regulations and operated as mobile laboratory on board of specially equipped cargo planes. The container has been outfitted with instruments for measurements of different environmentally relevant trace gases. The instruments are operated during the flight by two members of the Institute. Flight missions were mainly performed between Frankfurt, FRG, and Sao Paulo, Brazil. Latitudinal distributions have been determined for the trace gases CH/sub 4/, H/sub 2/O, O/sub 3/, CO, NO, NO/sub y/, CO/sub 2/, N/sub 2/O, CF/sub 2/Cl/sub 2/, CFCl/sub 3/, C/sub 2/F/sub 3/Cl/sub 3/, CHCl/sub 3/, CH/sub 3/CCl/sub 3/, CCl/sub 4/, C/sub 2/H/sub 2/, C/sub 2/H/sub 2/, C/sub 2/H/sub 6/,C/sub 3/H/sub 6/, C/sub 3/H/sub 8/, C/sub 4/H/sub 10/, C/sub 5/H/sub 12/, C/sub 6/H/sub 6/, and C/sub 7/H/sub 8/. The data are presented and discussed in this report. The results obtained between 1982 and 1987 show an increase of the upper tropospheric concentrations of several trace gases. The average annual increase is found to be 0.76% for CH/sub 4/, 0.16% for N/sub 2/O, 4.4% for CF/sub 2/Cl/sub 2/, 5.3% for CFCl/sub 3/, 17.2% for C/sub 2/F/sub 3/Cl/sub 3/, 4.5% for CH/sub 3/CCl/sub 3/ and 2.1% for CCl/sub 4/. (orig.) With 71 refs., 5 tabs., 210 figs.

11726 **(NP—9770207) Emission and biological effect of nitrogen-containing polycyclic aromatic compounds from diesel engines.** Grimmer, G.; Dettbarn, G.; Naujack, K.W. (Biochemisches Inst. fuer Umweltcarcinogene, Ahrensburg (Germany, F.R.); Umweltbundesamt, Berlin (Germany, F.R.)). [1988]. 19p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE89770207/JAW.

A capillary gas chromatographic method has been developed for the determination of 1-nitropyrene and other nitroarenes in the exhaust of diesel and gasoline engines. To check the chemical conversion of PAH to nitroarenes on the collecting-filter, the exhaust stream emitted during the ECE-test was allowed to pass a glass fiber filter either directly or after admixing of ammonia (VW Golf D, 5 ECE-tests without ammonia: x = 14.9 μg 1-nitropyrene/test; 5 ECE-tests with ammonia: x = 7.4 μg 1-nitropyrene/test). When a filter already loaded with exhaust particles is exposed a second time to the particle-free and non-cooled exhaust about the same amount of 1-nitropyrene is collected on the filter (x = 5.2 μg/test -> 9.5 μg/test). Keeping the temperature of the collecting arrangement below 35/sup 0/C, with as well as without admixing of ammonia no alteration of the 1-nitropyrene content on the filter could be detected with all diesel passenger cars investigated (each car 3 ECE-tests: VW Golf D, Datsun Bluebird D, Opel Kadett D, Mercedes 300 D, Mercedes 220 D). (orig.) With 6 refs., 2 tabs., 7 figs.

11727 **(NYSERDA—87-16-Vol.4) Results of the combustion and emissions research project at the Vicon Incinerator Facility in Pittsfield, Massachusetts: Volume 4, Appendices L-O: Final report.** (New York State Energy Research and Development Authority, Albany (USA); Midwest Research Inst., Kansas City, MO (USA)). Jun 1987. Contract FG01-85CE30838. 271p. NTIS, PC A12/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005632/JAW.

Atomspheric emissions of polychlorinated dibenzo-p-dioxins (PCDDs) and polychlorinated dibenzofurans (PCDFs) can be generated as a result of combustion of municipal solid waste (MSW). However, knowledge is limited about the incinerator design and operating conditions that cause these compounds to form and that can be adjusted to minimize or eliminate their discharge. This study focused on identifying the relationships between incinerator operating conditions, waste characteristics, combustion variables, and levels of PCDDs and PCDFs and selected other semivolatile organic compounds measured in the combustion gases. The study was designed primarily to evaluate the effect of the following parameters on levels of PCDDs/PCDFs in the combustion gases: Incinerator operating conditions; PVC content of the waste; Moisture content of the waste; and Combustion gas variables. Further, the study investigated the relationship between levels of PCDDs/PCDFs and other semivolatile organic compounds measured in the combustion gases.

11728 **(ORNL/TM—10144) An Adirondack Watershed Data Base: Attribute and mapping information for regional acidic deposition studies.** Rosen, A.E.; Olson, R.J.; Gruendling, G.K.; Bogucki, D.J.; Malanchuk, J.L.; Durfee, R.C.; Turner, R.S.; Adams, K.B.; Wilson, D.L.; Coleman, P.R. (Oak Ridge National Lab., TN (USA)). Dec 1988. Contract AC05-84OR21400. 243p. NTIS, PC A11/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005682/JAW.

The Adirondack Watershed Data Base (AWDB) provides a means to test hypotheses concerning the relative importance of various watershed attributes that may contribute to increased acidification of Adirondack surface waters. The AWDB is a valuable resource for the study of other ecological phenomena. The AWDB consists of digital watershed boundaries and digital geographic data, stored within a geographic information system, and watershed/lake attribute data stored in a data management system (SAS) for 463 Adirondack headwater lakes. Attributes include watershed morphology, physiography, bedrock, soils, land cover, wetlands, disturbances (e.g., cabins, fire, and logging), beaver activity, precipitation, and atmospheric deposition. Over 600 variables are available for each watershed. These data can be combined with water chemistry data and fish community status for regional-scale examinations of watershed attributes that may account for variability and change in water chemistry and fish populations in the Adirondacks. This report describes the design of the AWDB, documents sources and history of the data; defines the format of the AWDB contents; and characterizes the data using summary statistics, frequency bar charts, and other graphics. In addition, it provides information necessary for researchers using the data base on their own computer systems. 37 refs., 42 figs., 4 tabs.

11729 **(PB—89-103956/XAB) Historic SO_2 and NOx emissions estimates (for microcomputers). Data file.** Mobley, J.D.; Gschwandtner, G. (Environmental Protection Agency, Research Triangle Park, NC (USA). Air and Energy Engineering Research Lab.). 31 Mar 1988. vp. (EPA—600/7-88/009B). NTISCP D02.

The data file is contained on 5 1/4-inch, double sided, double density diskettes, compatible with the IBM PC/XT microcomputer. The diskettes are in the LOTUS 1-2-3 format. Price includes documentation PB—89-103964.

The data file contains the results of a comparison of historic SO_2 and NOx emission data sets. The diskette contains 12 files: ALFLSO2.WK1 SO_2 emissions for Alabama-Florida + U.S.; GALASO2.WK1 SO_2 emissions for Georgia-Louisiana; MEMTSO2.WK1 SO_2 emissions for Maine-Montana; NENDSO2.WK1 SO_2 emissions for Nebraska-North Dakota; OHTNSO2.WK1 SO_2 emissions for Ohio-Tennessee; TXWYSO2.WK1 SO_2 emissions for Texas-Wyoming; ALFLNOX.WK1 NOx emissions for Alabama-Florida + U.S.; GALANOX.WK1 NOx emissions for Georgia-Louisiana; MEMTNOX.WK1 NOx emissions for Maine-Montana; NENDNOX.WK1 NOx emissions for Nebraska-North Dakota; OHTNNOX.WK1 NOx emissions for Ohio-Tennessee; TXWYNOX.WK1 NOx emissions for Texas-Wyoming.

11730 **(PB—89-118335/XAB) SITE (Superfund Innovative Technology Evaluation) demonstration of the Shirco infrared incinerator.** Wall, H.O.; Rosenthal, S. (Enviresponse, Edison, NJ (USA)). Oct 1988. 16p. NTIS, PC A03/MF A01.

A Shirco Infrared System used for a removal action at a PCB-containing oil-refining waste site in Brandon, Florida (a suburb of Tampa) was evaluated. The evaluation included a determination of toxics in the material being decontaminated as well as all the effluent streams such as ash, air emissions and waste water. These streams were analyzed for heavy metals, organics, dioxins, furans as well as NOx, and inorganic acids. Leaching tests were performed on the ash. The results indicated that the PCB was reduced from 5 to 100 ppm to less than 1 ppm in the ash, which was the purpose of the removal action. Although research had indicated that the lead compounds in the ash would become insoluble because they would be complexed with carbon, the ash could not be considered non-leachable based on the EP toxicity tests.

11731 **(PB—89-118350/XAB) Evaluation of ozone-exposure indices for relating exposure to plant production and for estimating agricultural losses. Technical report.** Lee, E.H.; Tingey, D.T.; Hogsett, W.E. (NSI Technology Services Corp., Corvallis, OR (USA)). Oct 1988. 118p. NTIS, PC A06/MF A01.

The objective of the report is: (1) to compare alternative ozone exposure indices that relate well to plant response and are useful in developing future standards for ozone; (2) to estimate standard errors and confidence intervals of regression coefficients and exposure levels of fixed-yield losses. Plant growth data for soybean, wheat, corn, sorghum, and cotton, from NCLAN studies were regressed against the exposure indices. Optimum performance, when the minimum sum of squares criterion was used, was not attained for any single index across crops/species, sites, and years. However, indices that cumulated concentrations over time and emphasized ozone concentrations of 0.06 ppm or higher correlated well with plant growth. The censored cumulative sum of ozone concentrations of 0.06-0.07 ppm and a sigmoid-weighted cumulative index (centered at 0.062 ppm) were among the topranked indices, having potential as a future standard. These findings indicate that: (1) peak concentrations are important but lower concentrations should be included in the calculations; (2) increased plant sensitivity occurs between flowering and maturity; (3) plants respond to cumulative impact.

11732 **(PB—89-118376/XAB) Comparison of techniques for measurement of ambient levels of hydrogen peroxide (journal version).** Kleindienst, T.E.; Shepson, P.B.; Hodges, D.N.; Nero, C.M.; Arnts, R.R. (Northrop Services, Inc., Research Triangle Park, NC (USA)). 1987. 12p. NTIS, PC A03/MF A01.

Pub. in Environmental Science and Technology, Vol. 22, No. 1, 53-61(Jan 1988).

A study measured hydrogen peroxide (H_2O_2) from three sources: (1) zero air in the presence and absence of common interferences; (2) steady-state irradiations of hydrocarbon/NOX mixtures; and (3) ambient air. The techniques employed for measuring H_2O_2 included infrared absorption from a diode laser, fluorescence from an enzymatically produced complex, and chemiluminescence from reaction with luminol. Four systems, each of which utilized one of the above techniques, were compared with respect to sensitivity, selectivity, and dynamic range in measuring H_2O_2 concentrations ranging from 0.062 to 128 ppbv. There was no indication of interferences for an H_2O_2 level of 6 ppbv except in the luminol technique, where a negative interference was caused by SO_2. Agreement among techniques was much worse for measurement of H_2O_2 produced in the photochemical mixtures. Significant concentrations of organic peroxide were measured by the enzymatic technique. During ambient monitoring, the techniques employed showed quantitative agreement.

11733 **(PB—89-118384/XAB) Study of ammonia source at a Portland Cement production plant (journal version).** Cheney, J.L.; Knapp, K.T. (Environmental Protection Agency, Research Triangle Park, NC (USA). Atmospheric Sciences Research Lab.). 1987. 7p. (EPA—600/J-87/446). NTIS, PC A02/MF A01.

Pub. in Jnl. of the Air Pollution Control Association 37, 1298-1302(1987).

A source and process-sampling study was conducted at a dry process Portland Cement production plant. One aspect of the study focused on the source or point of NH3 within the production process. An extensive number of process solids from raw feeds to baghouse solids were collected and analyzed for NH4(1+). The results show the presence of NH4(1+) in many process samples, and that its collection efficiency in the baghouse is related to baghouse temperature. The data also show that NH_3 is derived from the shale used in the raw feed at this cement production plant.

11734 **(PB—89-118491/XAB) Relationships between direction of wind flow and fine-particle sulfur concentrations within and upwind of St. Louis, MO. (journal version).** Altshuller, A.P. (Environmental Protection Agency, Research Triangle Park, NC (USA). Atmospheric Sciences Research Lab.). 1987. 13p. (EPA—600/J-87/448). NTIS, PC A03/MF A01.

Pub. in Atmospheric Environment, Vol. 21, No. 5, 1023-1032(1987). See also PB—87-176707.

The relationships between the monthly averages of diurnal fine-particle sulfur concentrations and wind-flow direction with season of the year are evaluated using measurements at urban and rural locations within the St. Louis area. The results confirm and quantify the regional contribution to fine particle sulfur concentrations within the St. Louis urban area. The contribution of local-scale photochemical oxidation of SO_2 to particle sulfur to SO_2 is estimated as is the contribution of local-scale direct emissions of particle sulfur. Evidence is provided of downward mixing during the morning hours of fine-particle sulfur along with O_3 from layers aloft. A positive gradient in fine-particle sulfur concentrations from west to east is confirmed which is shown to be primarily the result of much lower concentration in flow from the northwest of the St. Louis area. These results are consistent with other monitoring measurements available from midcontinental non-urban locations.

11735 **(PB—89-118608/XAB) National Climate Program annual report, 1986.** (National Climate Program Office, Rockville, MD (USA)). Jan 1988. 57p. NTIS, PC A04/MF A01.

See also report for 1985, PB—87-190518.

Potential climatic effects of increased concentrations of atmospheric carbon dioxide and other greenhouse gases, a possible El Nino-Southern Oscillation event, ozone depletion, and drought in the southeastern United States were major scientific issues in the National Climate Program in 1986. The report summarizes these events and includes climate data, international activities, and budget details for 1980-1987.

11736 **(PB—89-118681/XAB) Evaluation of perchloroethylene emissions from dry-cleaned fabrics. Final report, March-May 1988.** Tichenor, B.A.; Sparks, L.E.; Jackson, M.D. (Environmental Protection Agency, Research Triangle Park, NC (USA). Air and Energy Engineering Research Lab.). Oct 1988. 51p. (EPA—600/2-88/061). NTIS, PC A04/MF A01.

This report gives results of short-term evaluation of perchloroethylene (perc) from dry-cleaned fabrics to determine: (1) how the introduction of fresh dry cleaning into a house affects the indoor concentration of perc, and (2) the effectiveness of 'airing-out' for reducing perc emissions. Small chamber tests were conducted to determine perc emission characteristics for three fabrics at several temperatures and air exchange rates. Test house studies were conducted to determine the indoor concentration of perc due to the placement of dry-cleaned clothing in the house. Based on study results, and assuming that test conditions were representative of normal dry-cleaning and consumer practices, the following conclusions were reached: (a) emissions from freshly dry-cleaned clothing cause elevated levels of perchloroethylene in residences; and (b) for the three fabrics tested, 'airing-out' of dry-cleaned clothing by consumers will not be effective in reducing perchloroethylene emissions. Significant variations in dry cleaning practices and/or in the mix of fabrics and clothing being cleaned could provide different results and conclusions.

11737 **(PB—89-118715/XAB) Determination of atmospheric dilution for emergency preparedness: a joint EPA-DOE (Environmental Protection Agency-Department of Energy) technical workshop held on October 15-17, 1986.** Rogers, S.E. (Research and Evaluation Associates, Inc., Chapel Hill, NC (USA)). Oct 1988. 257p. NTIS, PC A12/MF A01.

This workshop was held in Research Triangle Park, NC in October of 1986. The objectives of the workshop were to review the current methods of determining atmospheric dilution for use in hazard identification, emergency-preparedness planning, and emergency response; to provide recommendations for choosing among these methods; and, finally, to define the role of the meteorologist in hazard identification, emergency planning, etc. Several invited papers were presented, and panel discussions were held to meet the objectives. The results are presented and discussed.

11738 **(PB—89-118723/XAB) Baseline-emissions forecasts for industrial non-boiler sources. Final report, October 1985-March 1986.** Hogan, T. (Energy and Environmental Analysis, Inc., Arlington, VA (USA)). Oct 1988. 116p. NTIS, PC A06/MF A01.

This report gives regional air-emission forecasts from three Process Model Projection Technique (PROMPT) runs. These estimates illustrate a range of possible future emissions. PROMPT, one of a number of National Acid Precipitation Assessment Program emission-forecasting models, projects the emissions of nitrogen oxides and sulfur oxides from industrial sources such as process heaters, wood boilers, furnaces, dryers, kilns, engines, and turbines through the year 2030. It excludes emissions from the combustion of natural gas, distillate or residual fuel oil, or coal in industrial boilers.

11739 **(PB—89-118731/XAB) Emissions forecasts for industrial process sources. Final report, May-September 1986.** Hogan, T. (Energy and Environmental Analysis, Inc., Arlington, VA (USA)). Oct 1988. 58p. NTIS, PC A04/MF A01.

This report gives national and regional air emissions forecasts from several sulfur oxide and nitrogen oxide (SOx and NOx) emissions control Process Model Projection Technique (PROMPT) test runs. PROMPT, one of a number of National Acid Precipitation Assessment Program emission forecasting models, projects the emissions of NOx and SOx from industrial sources such as process heaters, wood boilers, furnaces, dryers, kilns, engines, and turbines through the year 2030. PROMPT excludes emissions from the combustion of natural gas, distillate or residual fuel oil, or coal in industrial boilers. These emissions forecasts have been generated from test data to ascertain model performance; they do not necessarily reflect EPA, DOE, or Interagency Task Force on Acid Precipitation policies or projections.

11740 **(PB—89-120166/XAB) Walk-through survey report, Cooperative Power Association, Underwood, North Dakota, February 27, 1979.** Matanoski, G.M.; Whitman, N.E. (Johns Hopkins Univ., Baltimore, MD (USA)). 22 Oct 1979. 11p. NTIS, PC A03/MF A01.

Worker exposures to paint materials were studied at the Coal Creek Station, Cooperative Power Association in Underwood, North Dakota, on February 27, 1979. The facility was under consideration for inclusion in a NIOSH study of the health effects of occupational paint materials exposure. Approximately 30 painters were employed under contract at the facility. The company had no formal safety and industrial hygiene program. Medical services were furnished by two staff nurses. Personnel records were thought to be maintained by the painters union. About 20,000 gallons of paint were expected to be used for the current contract project, and consisted of acrylic and oil alkyd, polyamine cured epoxy, epoxy coal tar, inorganic zinc primer, and modified silicone. The authors conclude that this work force should be considered for inclusion in the painting-hazard study.

11741 **(PB—89-120182/XAB) Survey for n-nitroso compounds at Uniroyal, Chicopee Falls Plant, Chicopee Falls, Massachusetts, September 22, 1978.** Reisch, J.; Rounbehler, D.P.; Fajen, J. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA)). Nov 1978. 16p. (IWS—072.31). NTIS, PC A03/MF A01.

Environmental samples were collected on September 22, 1978 to determine the workers' exposures to N-nitroso compounds, especially airborne volatile nitrosamines, at the Uniroyal tire factory in Chicopee Falls, Massachusetts. The area air samples contained N-nitrosomorpholine (NMOR) ranging from 0.03 to 0.6 micrograms per cubic meter, N-nitrosodimethylamine (NDMA) ranging from 0.03 to 0.2 micrograms per cubic meter, and N-nitrosodiethylamine (NDEA) ranging from 0.13 to 1.4 micrograms per cubic meter. The process air samples contained NMOR ranging from 0.73 to 22.0 mi-

crograms per cubic meter. High nitrosamine concentrations were associated with heating and increasing the surface of the rubber stock. Two unknown compounds were detected and determined not to be N-nitroso compounds, but acted like O-nitroso compounds.

11742 **(PB—89-120190/XAB) Survey for n-nitroso compounds at Armstrong Rubber Company, West Haven, Connecticut, September 20, 1978.** Rounbehler, D.P.; Fajen, J. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA)). 25 Jan 1979. 15p. (IWS—072.30). NTIS, PC A03/MF A01.

The passenger- and truck-tire manufacturing facility of Armstrong Rubber Company at West Haven, Connecticut was surveyed for N-nitroso compounds. The authors note that many of these compounds are animal carcinogens and are suspected to be human carcinogens. Area air samples were obtained from as close to defined processes as possible to determine the source of worker exposure to N-nitroso compounds with regard to airborne volatile nitrosamines. On September 20, 1978, 20 air samples were collected by solid-sorbent 1-normal potassium-hydroxide (1N KOH) solution, Tenax gas chromatography solid sorbents, Thermosorb tubes, and a high-volume air pump. All of the samples contained N-nitrosomorpholine (NMOR) and N-nitrosodimethylamine (NDMA). The NMOR concentrations ranged from 0.10 micrograms per cubic meter (micrograms/cu m) to 4 micrograms/cu m for area samples and from 0.4 to 9.2 micrograms/cu m in close proximity to specific processes. NDMA levels were 2 micrograms/cu m in four of the process air samples. NMOR and NDMA concentrations were 1.5 and 0.6 micrograms/cu m, respectively, for an air sample taken from inside a hot tire.

11743 **(PB—89-120208/XAB) Industrial-hygiene report: preliminary survey of wood-preservative treatment facility at Cascade Pole Company, McFarland Cascade, Tacoma, Washington, May 30, 1980.** Todd, A.S.; Timbie, C.Y. (Stewart-Todd Associates, Inc., Wayne, PA (USA)). 26 Jan 1981. 25p. NTIS, PC A03/MF A01.

Harmful exposures to wood-preserving chemicals were investigated at the Cascade Pole Company in Tacoma, Washington on May 30, 1980. Approximately 18 employees worked in areas of potential exposure. Area air samples were collected from the tap of cylinder doors and during the opening of cylinders during ammoniacal-copper-arsenate (ACA) and chromated-copper-arsenate (CCA) processing. Air samples also were collected from the top of treated-wood storage areas and wipe samples were collected from ACA and CCA processed woods. Samples were analyzed for copper (Cu), creosote, pentachlorophenol (PCP), chrome (Cr), and arsenic (As). All air samples were undetectable for Cu, As, and PCP. Creosote concentrations at the cylinder and on treated wood were 3.94 and 2.12 milligrams per cubic meter were measured gravimetrically and by ultraviolet light. Wipe samples from CCA and ACA treated woods contained trace amounts of Cu, Cr, and As ranging from 19 to 240 micrograms, with the highest concentrations found after ACA treatment. The authors conclude that the treated lumber presents a potential skin-exposure problem which would be eliminated by wearing protective gloves.

11744 **(PB—89-120216/XAB) Walk-through industrial-hygiene survey, wood-preservative treatment facility, Bell Lumber and Pole, New Brighton, Minnesota, June 27, 1979.** Todd, A.S.; Timbie, C.Y. (Stewart-Todd Associates, Inc., Wayne, PA (USA)). 4 Sep 1979. 18p. NTIS, PC A03/MF A01.

A preliminary survey of the Bell Lumber and Pole Company in New Brighton, Minnesota was conducted on June 27, 1979. Process methods, potential or known exposure conditions, and test sampling methods were assessed to determine if a comprehensive investigation was needed to evaluate long-term health effects associated with wood preserving. Fifteen of 27 employees at the facility treat utility poles with pentachlorophenol (PCP) using a nonpressure thermal process. Employee training and work practices, the occupational educational program, historical data, and results of safety and health monitoring were evaluated. General air sampling was conducted during regular operations at sites of potential exposure in order to evaluate different air-sampling methods, define analytical limitations, and obtain a range of exposure levels during critical short term tasks. PCP concentrations were measured 0.13 to 0.36 milligrams per cubic meter (mg/cu m) using a NIOSH procedure, and 0.27 to 1.33 mg/cu m using a silica-gel method. The authors conclude that differences in results using the NIOSH procedure and the silica-gel method could not be explained adequately because of the limited data obtained.

11745 **(PB—89-120224/XAB) Walk-through industrial-hygiene survey, Fasson Division, Materials Group of Avery International, Painesville, Ohio, May 3, 1979.** Salazar, A.; Zerwas, M.A. (SRI International, Menlo Park, CA (USA)). 26 Oct 1979. 21p. NTIS, PC A03/MF A01.

Worker exposures to toluene were determined at the Fasson Division of the Materials Group of Avery International in Painesville, Ohio, on May 3, 1979. The company was under consideration for inclusion in a NIOSH study of the health effects of occupational toluene exposure. Approximately 231 of the employees are assigned to the production areas surveyed. The company had no formal safety or industrial-hygiene program. Medical services were furnished by a local clinic and first-aid trained employees. Personnel records were available for active and inactive employees dating from 1974. Air-sample concentrations for toluene and total hydrocarbons were well below the existing OSHA permissible-exposure limit of 200 parts per million (ppm) for all areas tested. The authors concluded that the adequacy of this facility for a detailed industrial hygiene survey will be evaluated in light of its suitability for an epidemiologic study.

11746 **(PB—89-120240/XAB) Some characteristics of ozone formation in the urban plume of St. Louis, MO. (journal version).** Altshuller, A.P. (Environmental Protection Agency, Research Triangle Park, NC (USA). Atmospheric Sciences Research Lab.). 1988. 14p. (EPA—600/J-88/164). NTIS, PC A03/MF A01.

Pub. in Atmospheric Environment, Vol. 22, No. 3, 499-510(1988).

The O_3 measurements from the RAMS monitoring network in St. Louis in the upwind and downwind wind flow direction were used to evaluate the impact of the urban plume of St. Louis. Incremental O_3 formation within the urban plume compared to regional O_3 background increases both in frequency and intensity from spring into midsummer and declines again in late summer and early fall. Episodic periods with substantial increments of O_3 formation to the plume over background occur especially during the summer months. Aircraft measurement of O_3 are used in combination with surface measurements to estimate the transport distance and width of the plume of St. Louis. The significance is evaluated of incremental O_3 formation in the St. Louis plume on population exposures as well as on fumigations of field crops or forest in rural areas downwind. The results obtained from the St. Louis plume are discussed as they may apply to plumes from other cities, especially in interior regions of the United States.

11747 **(PB—89-120455/XAB) Walk-through industrial-hygiene survey report, Cincinnati Chemical Processing Company, Batavia, Ohio, August 5, 1977.** (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA). Div. of Surveillance, Hazard Evaluation and Field Studies). 5 Aug 1977. 25p. (IWS—082-10). NTIS, PC A03/MF A01.

A walk-through survey was conducted at the Cincinnati Chemical Processing Company, Batavia, Ohio where blending, grinding, spray drying, and packaging of various chemicals took place. Specific attention in this survey was given to the potential exposure to polybrominated biphenyls possible at the facility and to the evaluation of any possible associated health effects. A total of three employees worked for 9 months preparing about 140,000 pounds of PBB. Employees were observed using respirators, particularly when involved in emptying containers or operating grinders. At the facility, dermatitis had been a recurring occupational-health problem. The authors recommend: the current local exhaust system be modified to control dust exposure; hearing protective devices be required when the noise levels exceed 90 decibels-A; a respiratory protective program be established; NIOSH certified respirators be substituted for current respirators; a formalized occupational-health program be established to combat dermatitis; good-

housekeeping practices; containers in the storage area be stacked straight to prevent falling; and acceptable safety helmets be provided.

11748 **(PB—89-120570/XAB) Health-hazard evaluation report HETA 85-423-1904, General Electric Company, Evendale, Ohio.** Burr, G.; Singal, M.; Hartle, R.; Rondinelli, R. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA)). Jun 1988. 27p. (HETA—85-423-1904). NTIS, PC A03/MF A01.

See also PB—86-133691.

A study was made of possible health hazards at the General Electric Company, Evendale, Ohio. Workers were exposed to dusts generated during the grinding of tools and other components containing tungsten carbide. Employee exposure to cobalt, nickel, chromium, tungsten, and total and respirable dust levels were evaluated for 15 machinists working in two cutting and grinding areas. Concentrations of nickel ranged from nondetectable to 20 micrograms/cubic meter (microg/m^3), time weighted average, which exceeded the NIOSH recommended level of 15 microg/m^3). Other metals were below permissible levels. A group of 41 individuals participated in a medical study including chest x-ray and determination of blood and urine cobalt concentrations. No evidence of hard-metal disease was noted on the 38 x-rays taken. Only two of ten participants had detectable blood cobalt levels. Of 63 urine specimens, 19 showed detectable cobalt. The authors conclude that a potential hazard existed from airborne exposure to nickel in cutter/grinding areas, and that a potential health hazard from cobalt exposure existed in Building 500.

11749 **(PB—89-120588/XAB) Health-hazard evaluation report HETA 84-459 and HETA 85-110-1905, Budd Company, North Baltimore and Carey, Ohio.** Hartle, R.W.; Rondinelli, R. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA)). Jun 1988. 91p. (HETA—84-459). NTIS, PC A05/MF A01.

A study was undertaken of possible hazardous working conditions at the Budd Company locations in North Baltimore and Carey, Ohio. Concern was expressed over worker exposure to isocyanates, methylene chloride (MeCl) and other chemicals. Primary sources of worker exposures to MeCl were in the prime wipe operation, and the use of MeCl as a general cleaning solvent at various jobs and locations. MeCl exposures ranged up to 239 parts per million; NIOSH has recommended that levels be maintained at the lowest feasible level. All but one of the time-weighted average exposures to styrene were below the recommended limits. Some association was found between MeCl exposure and neurological symptoms. There were also associations between work involving repetitive motion and hand and arm symptoms; jobs involving potential isocyanate exposure were also associated with irritative and respiratory symptoms. The authors conclude that a potential hazard existed from overexposure to MeCl. The authors recommend that measures be taken to reduce or eliminate MeCl exposures, that isocyanates be monitored continuously and that jobs requiring repetitive motion be evaluated and redesigned.

11750 **(PB—89-120596/XAB) Determination of 1,3-butadiene in workplace air: reevaluation of NIOSH (National Institute for Occupational Safety and Health) Method S91 and development of NIOSH Method 1024.** Lunsford, R.A.; Gagnon, Y.T. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA). Div. of Physical Sciences and Engineering). 24 Aug 1988. 14p. NTIS, PC A03/MF A01.

NIOSH Method S91 for the determination of 1,3-butadiene in air was reevaluated, and a new method was developed. Limitations to Method S91 included the fact that the lower quantitation limit appeared to be about 3.4 parts per million (ppm) and the packed-column gas-chromatographic analysis was subject to interference. The new method developed, Method 1024, employed collection on tandem coconut-shell charcoal tubes, desorption with methylene chloride, and high-resolution gas-chromatographic analysis. Evaluation of Method 1024 indicated that it should be useful for determining full-shift time-weighted average exposures in humid air at concentrations ranging from 0.4 to 10 ppm. The sampler's capacity should permit quantitation of levels up to 100 ppm if desorbed samples are diluted so that they fall in the calibration range. In the chromatographic process, the combination of backflushable precolumn and aluminum oxide fused-silica capillary analytical columns offered the advantages of enhanced sensitivity enabling detection down to 0.005 ppm in 25 liters, and enhanced selectivity, limiting the need for confirmatory techniques.

11751 **(PB—89-120638/XAB) Health-hazard evaluation report HETA 86-428-1910, Commonwealth of Kentucky, Department of Transportation, Manchester, Kentucky.** Fidler, A.T.; Ruhe, R.; Hills, B. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA)). Jun 1988. 29p. (HETA—86-428-1910). NTIS, PC A03/MF A01.

An evaluation was made of possible hazardous working conditions at the Commonwealth of Kentucky Department of Transportation, Manchester, Kentucky. Specific attention was addressed to toluene and lead exposures during the painting of lines on roads. Because the paint used must be diluted with toluene before use, a high potential for exposure to lead and toluene exists during the mixing process. Air-quality measurements were taken at work sites during October and again during August of 1986 and 1987. Blood and urine tests were also conducted. All urine and blood samples showed no overexposures of any kind. The authors conclude that excessive exposures to toluene or lead were not found among road-painting operations workers; however, a potential for exposure existed. The authors recommend measures to reduce exposures to toluene and lead, including changing to paint with a higher toluene content, instituting an employee education program, labeling chemicals properly, improving personal hygiene and work practices, and using protective clothing.

11752 **(PB—89-120653/XAB) Health-hazard evaluation report HETA 87-435-1896, Wilbanks International, Inc., Hillsboro, Oregon.** Thun, M.; McCammon, C.; Wells, V. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA)). May 1988. 26p. (HETA—87-435-1896). NTIS, PC A03/MF A01.

An evaluation was made of possible hazardous working conditions at Wilbanks International, Hillsboro, Oregon. Three cases of kidney failure had occurred in male workers after performing similar jobs; each of these workers had been a hydrostatic press operator. Medical evaluations indicated minor renal dysfunction in two of 12 current Wilbanks employees who worked in or near the press area. Medical records, insurance claims and the U.S. End Stage Renal Disease registry were used to identify additional cases of kidney disease at this facility and five other Coors ceramics facilities; there was no excess of renal disease identified at the other facilities. Concern was noted about binder burnoff, which consists of partially combusted byproducts of polyethylene glycol, and which may occasionally vent into the plant from the kilns. Potentially nephrotoxic short chain glycol compounds may exist in these fumes. The authors conclude that a potential hazard may have existed from the recirculation of combustion byproducts from periodic kilns. The authors recommend that medical surveillance be instituted for renal disease in production workers. Engineering controls should be instituted to eliminate exposure to binder burnoff.

11753 **(PB—89-120661/XAB) Health-hazard evaluation report MHETA 88-020-1908, University of South Florida, Tampa, Florida.** Kullman, G.J.; Sanderson, W.T. (National Inst. for Occupational Safety and Health, Morgantown, WV (USA)). Jun 1988. 31p. (MHETA—88-020-1908). NTIS, PC A03/MF A01.

In response to a request from the University of South Florida, Tampa, Florida, an investigation was made of complaints among workers of chemical odors and irritation of the eyes, nose, and throat in the MHH Building 104. A questionnaire was completed by 67% of the 61 employees in this building. The most-frequent complaints included headaches, sinus problems, and stuffy indoor air in addition to the other complaints noted above. Two distinct odors were noted in these areas, one of which was linked to the carpet and carpet glue used. The second odor, a musty smell, was not entirely pinned down, but may have resulted from an inadequate ventilation system. None of the gases or vapors sampled were above any of the occupational limits. The authors conclude

that low-level indoor air pollutants from building materials and the suboptimal ventilation system may explain symptoms reported by workers. The authors recommend that changes should be made in the ventilation system, and replacing carpet and carpet glue in some areas should be considered. Water leaks should be repaired promptly, and water-damaged materials should be sanitized or replaced.

11754 **(PB—89-120984/XAB) Control-technology assessment of enzyme-fermentation processes. Technical report.** Martinez, K.F.; Sheehy, J.W.; Jones, J.H. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA). Div. of Physical Sciences and Engineering). Feb 1988. 84p. (DHHS/PUB/NIOSH—88-114). NTIS, PC A05/MF A01.

Walk-through surveys were conducted at eight facilities to determine the effectiveness of control techniques used in biotechnology firms to reduce the hazards involved in enzyme fermentation processes. In-depth surveys were conducted at three of these sites. Viable-process microorganisms, enzymes, and total-dust levels were studied in aerosol samples collected around potential emission sites. The concentration of microorganisms was highest around the filtering operations at two facilities. Lower levels at one site were due to inherently better containment characteristics of drum filters. The use of double mechanical steam seals on agitator shafts appeared effective in controlling microbial cultures inside the seed and fermentor tanks. Packed seals showed some leakage. Exhaust gases from the seed and fermentor tanks were another major emission source of production microorganisms. Viable emissions from process exhaust gases were not likely to be completely controlled by the use of water scrubbers. The information could serve as a source for comparing the effectiveness of process equipment in other fermentation operations. The effectiveness of the controls evaluated may be inadequate if potentially hazardous organisms are used by industry.

11755 **(PB—89-121008/XAB) Health-hazard evaluation report HETA 85-295-1907, General Electric Carboloy Systems, Detroit, Michigan.** Burr, G.; Sinks, T.H. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA)). Jun 1988. 49p. (HETA—85-295-1907). NTIS, PC A03/MF A01.

A study was made of possible hazardous working conditions at the General Electric Carboloy Systems, Warren, Michigan. At the site, 14,000 different tungsten-carbide and steel products were produced. Environmental and medical surveys were conducted in several of the buildings at the work site. The studies indicated a hazard to some employees in Building 6 from cobalt exposures. An automated system was being implemented in the building to perform operations such as powder weighing, milling, screening, and spray drying in enclosed vessels. These operations were performed manually under local-exhaust ventilation. The greatest exposures occurred to individuals who did not wear a particle mask and were determined to be 24.6 micrograms/cubic meter (microg/m^3). The authors recommend that single-use disposable respirators be replaced by half-mask or full-face respirators; that the respiratory protection program be redesigned; that smoking, eating, and drinking be prohibited when toxic materials are present; and workers be evaluated for early detection of pneumoconiosis.

11756 **(PB—89-121909/XAB) Effectiveness of catalytic converters on diesel engines used in underground mining. Information Circular/1988.** McClure, B.T.; Baumgard, K.J.; Watts, W.F. (Bureau of Mines, Twin Cities, MN (USA). Twin Cities Research Center). 1988. 20p. (BM-IC—9197). NTIS, PC A03/MF A01.

Library of Congress catalog card no. 88-600120.

The objectives of the report are to quantitatively assess the effects of catalytic converters on diesel-exhaust emissions and to make recommendations for their use. Information in the report is from a literature survey and contact research supported by the Bureau of Mines. Catalytic converters are effective in reducing CO, HC, and odors when the exhaust temperature is high enough so that the converter remains about 250°C. Converter temperature is dependent upon engine duty cycle. Catalytic converters increase sulfate emissions and slightly increase oxides of nitrogen (NO) emissions. In addition, in vitro bioassays have shown that catalytic converters produce soluble organic compounds, which have increased mutagenic activity with respect to untreated exhaust.

11757 **(PB—89-122907/XAB) Industrial-hygiene survey of the phosphate industry in Polk County, Florida, May 28, 1957.** (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA)). Apr 1958. 35p. (IWS—057.03). NTIS, PC A03/MF A01.

Worker exposure to dust, free silica, and fluoride concentrations were determined at facilities of the phosphate industry upon a request from the President of the International Chemical Workers' Union to the Surgeon General of the Public Health Service. Partial medical records were maintained and all employees received preemployment physicals. The dust in the dry mill area was well under 5% in free-silica content; fluoride concentrations of airborne dust at storage and shipping operations in this area at times considerably exceeded the American Conference of Government Industrial Hygienists threshold limit value (TLV) of 2.5 milligrams per cubic meter. Over half of the atmospheric fluoride concentrations at a chemical facility exceeded the TLV. The authors recommended that environmental and medical studies be conducted in the phosphate industry to determine the extent and magnitude of potential health hazards. The studies should include air sampling, routine urine fluoride analyses on workers in dry mill and chemical facility areas, and physical examinations of workers.

11758 **(PB—89-122923/XAB) Evaluation of environmental hazards associated with metal foundries located in the state of Utah, November and December, 1968.** Larsen, L.B. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA)). 5 Feb 1969. 6p. (IWS—040.16M). NTIS, PC A02/MF A01.

Environmental hazards in the metal foundry industry were investigated in Utah during November and December 1968. An unspecified number of foundries were evaluated. The primary hazards were related to silica-dust exposure and high noise levels. Potential hazards included exposure to smoke and gases generated during pouring operations, vapors and gases produced during shell-core molding, and fumes produced during the casting of brass. None of the foundries provided periodic physical or x-ray examinations for any employees. Numerous deficiencies in ventilation were found in all of the foundries. The author recommends more extensive surveys for several of the foundries, monitoring of health and hygienic conditions at the foundries by industrial hygienists, physical examinations of foundry workers to determine their present health status, and periodic medical examinations to detect early signs of occupational illness.

11759 **(PB—89-122931/XAB) Industrial-hygiene dust survey of Standard Pozzolan, Inc. Plant, Flagstaff, Arizona, November 14, 1962.** Craft, B.F. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA)). Dec 1962. 8p. (IWS—030.23). NTIS, PC A02/MF A01.

Air sampling for silica dust was conducted at Standard Pozzolan, Inc., near Flagstaff, Arizona, November 14, 1962. Air samples from the switch room contained 2.2 to 10.2 million particles per cubic foot (mppcf) of silica dust. Dust concentrations at the kiln operators station were 1.0 mppcf. An area sample at the station revealed dust concentration of 0.8 mppcf. In the machine shop, dust concentrations were 0.7 mppcf, while in the raw-material stockpile, dust concentrations averaged 11.2 mppcf. Counts of airborne silica dust did not exceed the recommended limits of 16 mppcf. The authors recommend that dust-type respirators be provided for workers exposed to substantial dust concentrations.

11760 **(PB—89-122949/XAB) Results of USPHS (United States Public Health Service) survey at Raybestos-Manhattan Asbestos Textile Plant, Charleston, South Carolina, January 1971.** Weidner, R. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA)). Dec 1971. 12p. (IWS—032.24C). NTIS, PC A03/MF A01.

Air sampling for asbestos dust was conducted by the United States Public Health Service at the Raybestos Manhattan Asbestos Textile Company in Charleston, South Carolina, during January 1971. Airborne concentrations of fibers greater than 5 microns in length per cubic centimeter (f/cc) ranged from 0.1 to 40.9 f/cc. Average exposure in the mule-spinning, ring-spinning, spin-doffing, dry-twisting, winding, spool-winding, winder-fixing, and tape-weav-

ing areas exceeded the emergency temporary standard for asbestos dust of 5 fibers per milliliter greater than 5 microns in length for an 8-hour time-weighted exposure. Forty-five samples exceeded the 15-minute concentration limit of 10 fibers per milliliter.

11761 **(PB—89-122980/XAB) Special asbestos dust and preliminary industrial-hygiene survey, Abex Corporation, Winchester, Virginia, February 7-11, 1972.** Dement, J.; Shuler, P. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA)). Feb 1972. 39p. (IWS—32.25D). NTIS, PC A03.

Asbestos exposures at the American Brakeblok Division of the Abex Corporation in Winchester, Virginia are evaluated on February 7 to 11, 1972. Facility design and operations are described together with sampling procedures. Tabulated data on ventilation measurements and individual worker exposures to asbestos is provided based on findings of an earlier survey. Housekeeping practices and use of personal protective equipment are reviewed. The authors conclude that excessive asbestos exposure occur in the mixing and performing areas. Recommendations include development of mechanical asbestos loading method for the mixers, use of approved respirators, improved ventilation, and welding of blast gates once new ventilation systems are installed.

11762 **(PB—89-122998/XAB) Walk-through survey report, Dravo Corporation, Engineering Works Ddivision, Neville Island, Pittsburgh, Pennsylvania, January 30, 1979.** Billings, C.; Lazar, C. (Johns Hopkins Univ., Baltimore, MD (USA)). Jun 1980. 28p. (IWS—074.46.10). NTIS, PC A03.

See also PB—86-138286. Portions of this document are not fully legible.

A walk-through survey was conducted on January 30, 1979, at the Engineering Works Division Shipyard of the Dravo Corporation in Pittsburgh, Pennsylvania, to determine whether this site would be suitable for inclusion in the in-depth survey of the shipbuilding-industry segment of the investigation of health hazards to painters. The shipyard is engaged in the design and construction of barges and towboats for river transport of bulk cargoes. Out of a workforce of 1,200 production personnel, there are 10 spray painters, 13 brush painters, 3 sign painters, and 10 painters' assistants. The painters have a low turnover rate and the company has personnel records dating back to World War I. A safety and industrial-hygiene program operates at the facility and requires respiratory usage and various engineering controls for many painting operations. The authors conclude that the facility needs a better industrial-hygiene program than is now in effect. They recommend that the facility be included for consideration in the final study.

11763 **(PB—89-123020/XAB) Indoor-air-pollution source data base.** Bare, J.C. (Environmental Protection Agency, Research Triangle Park, NC (USA). Air and Energy Engineering Research Lab.). 1988. 5p. (EPA—600/J-88/178). NTIS, PC A02/MF A01.

Pub. in JAPCA, Vol. 38, No. 5, 670-671May 1988).

This paper, directed to individual interested in indoor air pollution, is an introduction, and directions for the use of, the EPA indoor air-pollution source data base (also known as the indoor air-source-emissions data base). The data base is a computerized system containing source characterization studies done in the U.S. and abroad. It addresses the entire range of indoor air sources. It provides ready access to such information as: emission factors determined for each of the pollutants and sources tested, data about the test facility, conditions of the experiment, sampling and analytical data, and an abstract of each publication. The program also includes options for researchers carrying out their own source-characterization studies. The data base is currently available in a dBase III version or a Clipper compiled version.

11764 **(SNV—3064) Discharge of acidifying compounds. Experience - Technical development. Emission limiting measures.** (National Swedish Environmental Protection Board, Solna). 1985. 33p. (In Swedish). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755853/JAW.

In 1985 the Swedish parliament approved the aim to reduce emissions of sulfur dioxide and nitrogen oxides by 65% and 30% respectively till 1995, going out form the 1920 level. From this report it appears that release of sulfur and nitrogen oxides up to 1984 had decreased by 45% and 10% respectively. Between 1983 to 1984 the release of sulfur dioxide decreased by approx. 20000 tons. The nitrogen oxide discharges remained however unchanged. The process industry discharges of sulfur and nitrogen oxides have not changed noticeably between 1983 to 1984. The government bill on actions against air pollution and acidification (prop 1984/85:127) states that the process industry discharges of sulfur dioxides should be halved during a ten year period in comparison with the 1983 level. The dishcharge of nitrogen oxides from road traffic displays an increase so far in the eighties. The report presents the results of the certification activities and after control program for exhaust gas release from petrol propelled vehicles. The report also presents available purification technique for limitation of acidifying discharge from industrial processes and energy production plants. (O.S.).

11765 **(SNV—3287) Pollution reduction. Environmental consequences of exhaust gas demands for trucks and buses.** Olsson, L. (National Swedish Environmental Protection Board, Solna). Apr 1987. 171p. (In Swedish). NTIS (US Sales Only), PC A08/MF A01. Order Number DE88755855/JAW.

The report presents basic data for the National Swedish Environmental Protection Board report on exhaust gas demands for trucks and buses. (With 28 refs.) (O.S.).

11766 **(SNV—3358) Effects of sulfur dioxide and nitrogen oxides. Basic information for air quality guidelines.** Nilsson, J. (National Swedish Environmental Protection Board, Solna). 1987. 35p. (In Swedish). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755859/JAW.

This report presents basic information for adopting air quality guidelines for sulfur dioxide and nitrogen oxides in Sweden. This information is extracted from already published material. The suggested limits and the observed depositions are given, as well as a review on the effects on plants. (L.E.).

11767 **(SNV—3389) Inorganic and organic compounds in emissions from diesel powered vehicles. A literature survey.** Westerholm, R. (Stockholm Univ. (SE). Dept. of Analytical Chemistry). (National Swedish Environmental Protection Board, Solna). Dec 1987. 59p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88755860/JAW.

This report comprises the findings of a literature survey of the chemical compounds of diesel exhaust emissions, special attention being paid to heavy duty diesel trucks. Fourhundred and forty-five compounds which have been identified or tentatively identified as constituents in the emitted exhaust emissions are listed together with molecular weights and references. A discussion is made of the tasks concerning sampling of automotive exhaust emissions, regulated and unregulated pollutions, fuel dependent emissions and diesel engine emissions in the future are discussed. Emission levels of certain arbitrarily selected compounds are also tabulated. The reference list consists of 86 references.

11768 **(SNV—3401) Effects of vehicle emissions near highways.** Sjoedin, Aa.; Ahlfors, A.; Skaerby, L.; Grennfelt, P. (Swedish Environmental Research Inst., Goeteborg). (National Swedish Environmental Protection Board, Solna). Nov 1987. 96p. (In Swedish). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88755861/JAW.

The present report deals with effects of vehicle exhausts in the vicinity (0-100 m) of a highway. In the first part of the report the current knowledge about the distribution, transformation, concentration gradients, and deposition of nitrogen oxides and hydrocarbons from road traffic, is summarized. This knowledge is based on field studies, laboratory experiments, and modelling conducted in Sweden and abroad. The second part of this report consists of a literature review of the effects of road traffic-related air pollutants on vegetation. Both certain types of hydrocarbons and various forms of nitrogen oxides have been shown to have had adverse effects on vegetation on their own, at high concentration levels. Our knowledge about the effects of vehicle exhausts components, either

alone or in combination, at low concentration levels and long term exposure is still very scanty. In the report, an effect assessment for near-road vegetation is made, with ethene and NO/sub 2/ considered to be the most critical components of the exhausts as regards direct effects of individual substances. As for combined effects the near-road content of NO/sub 2/ and O/sub 3/ is assumed to reach a level where there is a risk of effects on vegetation. Near-road vegetation is continuously affected by vehicle exhausts. Among the effects noted in the vicinity of roads with a large traffic volume are decreased frost resistance, premature senescence (leaf or needle loss), impaired crop quality (decreased content of vitamin C, spotted leaves), a higher incidence of parasitic attacks, and impaired pollen viability. Finally, elevated lead and nitrogen loadings are assumed to cause indirect effects on near-road vegetation. (With 129 refs.) (authors).

11769 **(SVF—306) Dilution probe technique for emission measurements of air pollutants. Experiences from field measurements.** Nyqvist, G.; Radoe, J.; Vesely, V. (Statens Naturvaardsverk, Solna (SE)). (Stiftelsen foer Vaermeteknisk Forskning, Stockholm (Sweden); National Swedish Environmental Protection Board, Solna). May 1988. 108p. (In Swedish). (SNV—3468). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88755922/JAW.

Continuous measurements of certain gaseous pollutants in stack gases from stationary sources are often performed through extractive sampling. The reliability of these emission measurements are strongly influenced by the method of sampling and conditioning of the hot, dusty and corrosive stack gases. In this investigation, an EPM (Environment and Process Monitoring) diluting stack sampler has been used. Dilution probe technology may be generically defined as a sampling technique whereby a small continuous sample is filtered and diluted at stack temperature prior to transport to a set of analyzers. The purpose of the investigation was to test function, reliability and maintenance need of the diluting stack sampler. Measurements were performed at combustion plants for three months in Nykoeping (circulating fluidized bed; coal firing and sulfur reduction) and Vaesteraas (coal-dust firing). The experience from the diluting stack sampler after field measurements during six months is excellent. The system worked all the time without any problems. The only maintenance needed was the cleaning of the coarse filter once a week. The conclusion of this investigation is that the dilution probe technique is easy to handle and maintain and is a reliable way to prepare gas samples for measurements of gaseous air pollutants from combustion plants. (authors).

11770 **(UCRL—99998) Greenhouse warming: What do we know?.** MacCracken, M.C. (Lawrence Livermore National Lab., CA (USA)). 16 Nov 1988. Contract W-7405-ENG-48. 11p. (CONF-8811126—1). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004780/JAW.

From Conference on the implications of climatic change for California; San Francisco, CA, USA (21 Nov 1988).

The continuing emissions of gases that are able to increase the efficiency with which the atmosphere traps infrared radiation are beginning to alter the global climate. During the next century, theoretical simulations project that global average temperatures will rise by several degrees Celsius above their pre-industrial baseline and that precipitation patterns may shift seasonally and spatially. Although research is being intensified so that detailed regional estimates can be provided, projected increases in summer temperatures and the accompanying increased evaporation, especially during natural warm excursions such as the summer of 1988, appear to pose troubling conditions for water supplies, agriculture, transport, and other activities dependent on water resources. 9 refs., 2 tabs.

11771 **High-order multiphoton ionization photoelectron spectroscopy of nitric oxide.** Carman H.S. Jr.; Compton, R.N. (Chemical Physics Section, Health and Safety Research Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee 37831-6125). *Journal of Chemical Physics;* **90**: No. 3, 1307-1312(1 Feb 1989).

Resonance-enhanced and nonresonant five- and six-photon ionization of NO was studied using angle resolved photoelectron spectroscopy. The (3+3)= resonance-enhanced multiphoton ionization photoelectron spectrum (REMPI-PES) of NO via the A $^2\Sigma^+$ (v = 0) level yielded a distribution of electron energies corresponding to all accessible vibrational levels (v^+ = 0—6) of the nascent ion. The observed energy distributions suggest near resonant enhancement due to vibrational levels of the D $^2\Sigma^+$ and C ^{2}Pi states at the fourth photon level. Angular distributions of photoelectrons corresponding to v^+ = 0 and v^+ = 3 (rotationally unresolved) were significantly different, perhaps reflecting these different pathways. The (3+2) REMPI via the A $^2\Sigma^+$ (v = 1) level produced only one low-energy electron peak corresponding to v^+ = 1. Nonresonant MPI at 532 nm yielded a distribution of photoelectron energies corresponding to both four- and five-photon ionization. Prominent peaks in the five-photon ionization photoelectron spectrum show that near resonant enhancement occurs via the A $^2\Sigma^+$ (v = 5), the C ^{2}Pi(v = 2) and the D $^2\Sigma^+$ (v = 1) states at the three-photon level. This study amply demonstrates the utility of angle resolved MPI-PES in understanding high-order multiphoton ionization processes.

11772 **Ozone calculations with large nitrous oxide and chlorine changes.** Kinnison, D.; Johnston, H.; Wuebbles, D. (Department of Chemistry, University of California, Berkeley Materials and Chemical Sciences Division, Lawrence Berkeley Laboratory, Berkeley, California). *Journal of Geophysical Research;* **93**: No. D11, 14165-14176(20 Nov 1988).

The purpose of this study is broadly to reinvestigate NO/sub x/—Cl/sub x/ interactions relative to ozone control in the stratosphere, using the long-established Lawrence Livermore National Laboratory one-dimensional model. To obtain perspective on reasonably expected atmospheric perturbations, this study includes unrealistic conditions in the calculations, and several interesting or unexpected features are found. (1) By varying both NO/sub x/ and Cl/sub x/ over wide ranges, regions are found where ozone column reduction is linear and nonlinear in added chlorine or in added nitrogen oxides. (2) If the stratosphere had much less NO/sub x/ than the natural amount, small chlorine increases would cause large reductions of ozone. (3) At high Cl/sub x/, a region of NO/sub x/—Cl/sub x/ space is found where added NO/sub x/ (at constant Cl/sub x/) increases the ozone column, but no region was found where added chlorine (at constant nitrous oxide boundary condition) increases the ozone column.

5003 Radioactive Materials Monitoring And Transport

REFER ALSO TO CITATION(S) 11071, 11139, 11893, 11909

11773 (INIS-mf—11332, pp 24) **Radiological environmental impact related to reactor accidents.** Altieri, S.; Pedroni, P. (Pavia Univ. (Italy); Istituto Nazionale di Fisica Nucleare, Pavia (Italy)). 1988. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705189/JAW. (CONF-8809213—).

From IAEA Meeting: 10th European TRIGA users' conference; Vienna, Austria (14 Sep 1988).

11774 **(PB—89-116149/XAB) Production of radon-resistant foundations. Final report.** Scott, A.G.; Findlay, W.O. (American ATCON, Inc., Wilmington, DE). Sep 1987. 54p. (FIPR/PUB—05-021-058). NTIS, PC A04/MF A01.

Two houses with radon-resistant monolithic-slab foundations and a crawl-space house were built on a reclaimed phosphate mining area with soil radium concentrations of 5 to 12 pCi/g in Bartow, Florida. The houses also included a number of additional features suggested as methods for increasing the radon resistance of foundations. These were a site membrane, an improved subslab vapor-barrier membrane, and passive subslab ventilation. Construction of the foundations was monitored to identify field problems, and the costs of the individual features were identified. A six-month measurement program found that the average radon concentrations in all three houses were less than 2 pCi/1. Conventional housing on reclaimed land of that radium content would have been expected to have average radon concentrations greater than 10 pCi/1. Radon-resistant slab-on-grade foundations can be produced cost-effectively by the use of monolithic concrete foundations with sealed plumbing openings in the slab and subslab barrier membrane, and improved concrete practice. The additional radon-resistant features did not

appear to have any value in this study. The site membrane was found difficult to use, expensive, and not very effective.

11775 **(PB—89-117634/XAB) National Radon Measurement Proficiency (RMP) program: cumulative proficiency report. Report for March-September 1988.** (Office of Radiation Programs, Washington, DC (USA)). Sep 1988. 172p. (EPA—520/1-88/024). NTIS, PC A08/MF A01.

This report is intended for use by Federal, State, and local officials, radon-measurement companies, radon-mitigation contractors, concerned homeowners, and other persons as an aid in selecting reliable sources of radon measurement services. The report includes a complete listing of participants who met EPA's National Radon Measurement Proficiency (RMP) Program requirements during Test Round 5, conducted between March through September 1988, providing each participant's performance record, service area, address, and telephone number. It also indicates whether participants are laboratories or distributors, and whether or not they have an EPA-approved quality assurance plan.

5006 Regulations

REFER ALSO TO CITATION(S) 11162, 11730

11776 **(EML—518) Semi-annual report of the Department of Energy, Operational Safety, Health and Environment Division: Quality Assessment Program.** Sanderson, C.G.; Feiner, M.S. (USDOE Environmental Measurements Lab., New York). 2 Jan 1989. 88p. NTIS, PC A05/MF A01 - OSTI. Order Number DE89005027/JAW.

This report presents the results from the analysis of the 29th set of environmental quality assessment samples (QAP XXIX) that were received on or before December 2, 1988.

11777 **(SNV—3517) Pollution control in Sweden.** Persson, G. (National Swedish Environmental Protection Board, Solna). Jul 1988. 30p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755868/JAW.

This report contains following main headings: 1. Historical antecedents and impetus for pollution control. 2. Major pollution problems. 3. National and other policies. 4. Implementation. 5. References. 6. Appendix. The appendix gives a list of agencies, institutes and organizations concerned with pollution control.

51 ENVIRONMENTAL SCIENCES, TERRESTRIAL

5101 Basic Studies

REFER ALSO TO CITATION(S) 11792

11778 (ACUNS—88, pp 98-103) **The freezing and thawing of a subarctic fen, Schefferville, Que.** Kingsbury, C.M.; Moore, T.R. (McGill Univ., Montreal, Que.). 1988. Association of Canadian Universities for Northern Studies, 130 Albert Street, Ottawa, Ont., Canada K1P 5G4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN. (CONF-8511343—; MICROLOG—88-02606).

From National student conference on northern studies; Ottawa, Canada (18 Nov 1985).

Northern environments are highly susceptible to thermal change caused by resource development activities (eg. construction of pipelines, roads and railways). In northern Canada, 25% of the landmass is composed of peatlands. Background information is needed about natural thermal regimes of peatlands, so that if they are disturbed, damage can be kept to a minimum. From late October 1984 to August 1985, temperatures were measured to a depth of 1.5 m in a subarctic fen near Schefferville, Quebec. Winter cover components (snow, white and black ice, and seasonal groundfrost) were also monitored. Freeze-up was initiated by a rapid groundfrost development and ice growth in wet depressions. However, an insulating snow cover of 13 cm (in Nov.) greatly reduced the growth rate of groundfrost to 3.6 mm per day. The snowcover gradually grew to a maximum thickness of 68 cm, which decreased the freezing rate to 0.6 mm per day by May. Also, a lowering of the water-table within the fen created a dehydrated layer beneath the freezing front. The maximum freeze depth of about 1 m was obtained in May. Thaw began in early May, with the snowcover beginning to melt. Susequently, meltwater pooled on the frozen peat and began to warm the surface layers. The groundfrost began to melt from both above and below, creating a major ice lens within the peat, which finally melted completely in early August. With the frost thawed, the temperature in the fen warmed up quickly to an average peat temperature of 15.7/sup 0/C. 24 refs., 4 figs., 3 tabs.

11779 **(INP—1281/AP) Measurement of macroscopic neutron absorption cross sections and other macroparameters of rocks.** Czubek, J.A. (Institute of Nuclear Physics, Krakow (Poland)). 1985. 46p. (CONF-8410497—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705284/JAW.

From 14. meeting of the International Nuclear Data Committee; Vienna, Austria (1 Oct 1984).

The present state of the art in experimental techniques for determination of neutron parameters of rocks is presented. For thermal neutrons the methods of determination of absorption cross section of the rock matrix samples are reviewed in three main groups: when the nuclear reactors are used, when the pulsed neutron generators are applied, and for the steady state neutron source technique. The experimental results obtained for different rocks are given for all the above mentioned methods together with the discussion of the standard deviations involved in each method. Among other neutron parameters experimental methods and results obtained for the slowing down and diffusion length measurements are given. Lack of experimental techniques which could be applied for determination of other rock neutron parameters is evident from this short review. The importance of the experimental determination of rock neutron parameters is discussed. Prospects for future development required in the field of rock neutron parameters are presented from the point of view of the very deep borehole projects under way, where the experimental data for rock neutron parameters compatible with the high temperature existing in deep boreholes should be studied. 29 refs., 2 figs., 14 tabs.

5102 Chemicals Monitoring And Transport

REFER ALSO TO CITATION(S) 10704, 10810, 11179, 11683, 11707, 11768, 11801, 11920, 11921

11780 **(ARC/NRD—87-1) Soil sensitivity to acid deposition and the potential of soils and geology in Alberta to reduce the acidity of acidic inputs.** Holowaychuk, N.; Fessenden, R.J. (Alberta Research Council, Edmonton (Canada). Natural Resources Div.). 1987. 42p. (MICROLOG—88-03184). Alberta Research Council, Editing and Publications Sales Dept., 5th. Floor, Terrace Plaza, 4445 Calgary Trail South, Edmonton, Alta., Canada T6H 5R7; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

The objective of this project was to prepare maps of Alberta showing the distribution of soils relative to their sensitivity to acid deposition and the distribution of soils and geology relative to their potential to reduce the acidity of atmospheric deposition. Descriptive information was assembled and synthesized for mineral soils and peatland systems throughout the province. The sensitivity of three soil processes - sensitivity to base loss, sensitivity to acidification, and sensitivity to aluminum solubilization - were rated separately for each map unit, then combined into an overall sensitivity rating. For peatland systems, three categories were recognized (eutrophic, mesotrophic, and oligotrophic) according to pH and base cation content of the organic matrix-ambient water systems. Expressed as a percentage of the total area of the province, soils of high sensitivity occupy 22.7%, soils of medium sensitivity 30.6%, and soils of low sensitivity 44.4%. The major groups of soils in the high sensitivity category are the mesotrophic peatlands and Dystric

Brunisols, both primarily located in the northeastern region. All map units were also rated for their potential to reduce the acidity of atmospheric deposition. Soils (and associated geology) with high potential occupy 64.4% of the province, soils with medium potential 21.8% and soils with low potential 11.3%. Most of the province's southern half and the Peace River region are occupied by soils with high potential to reduce acidity. 53 refs., 1 fig., 7 tabs.

11781 **(BCMEP—8710) Sensitivity of western and northern Canada soils and geology to acidic imputs.** Wiens, J.H.; Padbury, G.A.; Fessenden, R.B.; Wotton, D.L.; Senyk, J.P.; Paquin, E.; Holowaychuk, N. (British Columbia Ministry of Environment and Parks, Victoria (Canada); Manitoba Dept. of Environment and Workplace Safety and Health, Winnipeg (Canada). Environmental Control Services; Alberta Dept. of the Environment, Edmonton (Canada); Northwest Territories Dept. of Renewable Resources, Yellowknife (Canada)). 1987. 52p. (MICROLOG—88-04601). British Columbia Legislative Library, Government Documents Division, Parliament Buildings, Victoria, B.C., Canada V8V 1X4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

A series of maps has been prepared of the western and northern parts of Canada showing the potential of soils and geology to reduce acidity of atmospheric deposition, and showing the sensitivity of soils to acidic inputs. This report describes the objectives of this mapping project and the mapping methodology used. Sensitivity/potential rating criteria are defined and reviewed, the differences in data sources and methods are highlighted, and the limitations of sensitivity/potential ratings are discussed. A section on general observation of the sensitivity maps highlights the areas, within each province and territory mapped, that are of high or low sensitivity/potential. Limitations to the use of these maps are outlined; these include differences in consistency between mapping jurisdictions, database inadequacies, generalizations and simplifications, and gaps in the research upon which the rating criteria were based. 29 refs., 7 figs., 2 tabs.

11782 **(INIS-BR—1390) Chemical characterization of Amazon basin aerosols during GTE/ABLE-2A based on Pixe, EPMA, LAMMA and receptor modelling.** Artaxo, P.; Maenhaut, W.; Grieken, R. van. (Sao Paulo Univ., SP (Brazil). Inst. de Fisica; Gent Univ. (Belguim). Inst. for Nucleous Sciences; Antwerp Univ., Wilrijk (Belgium)). (Bahia Univ., Salvador (Brazil)). 1987. 2p. (CONF-8709392—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88705185/JAW.

From 2. International Environmental Chemistry Congress; Salvador, Brazil (16 Sep 1987).

11783 **(PB—89-120877/XAB) Control of toxic emissions from the thermal treatment of contaminated soils.** Edwards, L.; Fuchs, M.; Wall, H.O.; Rosenthal, S. (Radian Corp., Sacramento, CA (USA)). Nov 1988. 22p. NTIS, PC A03/MF A01.

The U.S. Environmental Protection Agency (EPA) is investigating technologies to clean up hazardous-waste sites through the Superfund Innovative Technology Evaluation (SITE) Program. Two sites having PCBs and heavy metals were demonstrated using the Shirco Infrared System, a roasting process. These locations were at Peak Oil, Brandon Florida and Rose Township, Michigan. Average values of contaminants in the material being thermally treated for decontamination are given as well as average values of emissions to the air, waste-water analysis and decontaminated soil analyses.

11784 **(SNV—3518) Liming as a measure to improve soil and tree condition in areas affected by air pollution. Results and experiences of an ongoing research programme.** Andersson, F.; Persson, T. (eds). (National Swedish Environmental Protection Board, Solna). Jul 1988. 132p. NTIS (US Sales Only), PC A07/MF A01. Order Number DE88755869/JAW.

A Swedish programme to counteract forest soil acidification started in 1983. This report provides an overview of experiences and major conclusions after five years. Strategies and goals as well as existing Swedish experiments are presented. Some basic soil chemistry as regards acidification and liming is given as a background to effects found on soil chemistry, soil biology including roots and mycorrhiza, tree growth and forest regeneration. Liming with doses of 5-10 tonnes/ha gives a long-lasting effect on soil chemistry. However the effect on the soil is slow. In nitrogen deficient environments liming affects net nitrogen mineralisation, which seems to be a key factor in regulating the growth response of trees. Liming with calcium carbonate on poor soils leads to a growth depression period of 10-20 years, which may be followed by a slight growth increase. Norway spruce seems to react with a more pronounced growth decline than Scots pine. The report also deals with some preliminary results concerning the acidification of Swedish soils. Using West German criteria for liming, areas in SW Sweden fulfill the requirements for liming. A dose of 2-5 tonnes/ha is recommended for areas to be limed to improve soil and root environment. Higher doses are required to avoid leaching of aluminium from catchments to ground and surface water. The base for recommendations is still incomplete. Liming is considered as a long-term measure for soil amelioration. Considering the long-term effect of deposition of acidifying sulphur and nitrogen compounds leading to nutrient imbalances in trees, a combined liming and tree vitality fertilization is recommended. A research and development programme for these countermeasures is suggested. (authors).

5103 Radioactive Materials Monitoring And Transport

REFER ALSO TO CITATION(S) 10790, 10810, 11139, 11773, 11812, 11893, 11909

11785 **(EGG—10617-1003) An aerial radiological survey of the Clinton Power Station and surrounding area, Clinton, Illinois, September 1987.** Guss, P.P. (EG and G Energy Measurements, Inc., Las Vegas, NV (USA)). Oct 1988. Contract AC08-88NV10617. 14p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005153/JAW.

An aerial radiological survey was conducted over the Clinton Power Station, Clinton, Illinois, during the period 22 September--2 October 1987. The purpose of the 256-square-kilometer (100-square-mile) survey was to document the terrestrial gamma environment of the plant and surrounding area. An exposure rate contour map extrapolated to 1 meter above ground level values was constructed from the gamma data and overlaid on an aerial photograph and map of the area. The activity profile of the survey area was extremely uniform, in the range of 10 to 12 microroentgens per hour (μR/h), with the exception of the town of Weldon and the parking lots surrounding the power station. In both cases, the activity was 1 to 2 μR/h lower than the surrounding terrain due to a smaller concentration of natural radioactive nuclides in the surface material of these areas. The only enhanced exposure rate observed in this survey was associated with the reactor unit. Ground-based exposure rate measurements and soil samples were obtained to support the aerial data. Oblique aerial photographs of the plant were also acquired during the survey. 10 refs., 6 figs., 1 tab.

11786 **(INIS-BR—1389) Study on influence of calcium in soils by uptake of Ra-226 by vegetables.** Vasconcellos, L.M.H.; Khede, R.C.; Amaral, E.C.S.; Azevedo, H.L.P. de; Vianna, E.C.M.; Franca, E.P. (Instituto de Radioprotecao e Dosimetria, Rio de Janeiro, RJ (Brazil); Rio de Janeiro Univ. (Brazil). Inst. de Biofisica). (Bahia Univ., Salvador (Brazil)). 1987. 2p. (In Portuguese). (CONF-8709392—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88705184/JAW.

From 2. International Environmental Chemistry Congress; Salvador, Brazil (16 Sep 1987).

11787 **(INIS-BR—1391) Emissions from Chernobyl: contaminations of food and beverages: preventing and remedial actions.** Paschoa, A.S. (Pontificia Univ. Catolica do Rio de Janeiro, RJ (Brazil)). (Bahia Univ., Salvador (Brazil)). 1987. 2p. (CONF-8709392—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88705186/JAW.

From 2. International Environmental Chemistry Congress; Salvador, Brazil (16 Sep 1987).

11788 (INIS-mf—11332, pp 39) **Determination of essential and trace elements in milk and measurement of short-lived nuclides in some samples using FIMs.** Demiralp, R.; Kalayoglu, S.; Uenseren, E.; Grass, F.; Boeck, H. (Istanbul Technical Univ. (Turkey). Inst. for Nuclear Energy; Atominstitut der Oesterreichischen Universitaeten, Vienna). 1988. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705189/JAW. (CONF-8809213—).

From IAEA Meeting: 10th European TRIGA users' conference; Vienna, Austria (14 Sep 1988).

11789 **(INIS-mf—11880) Acquisition and validation of transfer data for Ru from reprocessing plants.** Blasius, E.; Huth, R.; Krumrey, R.; Neumann, W.; Woll, G. (Universitaet des Saarlandes, Saarbruecken (Germany, F.R.). Inst. fuer Analytische Chemie und Radiochemie). [1988]. 25p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756499/JAW.

The aim of the investigation is to determine the ruthenium transfer factor from soil to plants on the basis of selected useful plants and food plants, namely potatoes, summer wheat and pasture grass. For this purpose ruthenium is used in the form of dioxide, chloride and nitrosyl complexes. Tests are made in field patches with inactive ruthenium and in isotope laboratories with Ru-106 or Ru-103. After the harvest of the plants the ruthenium is determined by means of electrothermal atomic absorption spectrometry in pyrolytically coated graphite pipes.

5105 Site Resource And Use Studies

REFER ALSO TO CITATION(S) 10732, 10745, 10746, 10747, 10748, 10749, 10750, 10830, 10889, 11618, 11785

5106 Regulations

REFER ALSO TO CITATION(S) 10790, 11162, 11776, 11777, 11783

52 ENVIRONMENTAL SCIENCES, AQUATIC

5201 Basic Studies

REFER ALSO TO CITATION(S) 10706

11790 (ACUNS—88, pp 305-312) **The distribution of bowhead whales (Balaena mysticetus) in the southeast Beaufort Sea, July - September, 1984.** Harwood, L.A.; Borstad, G.A. (Univ. of Alberta, Edmonton). 1988. Association of Canadian Universities for Northern Studies, 130 Albert Street, Ottawa, Ont., Canada K1P 5G4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN. (CONF-8511343—; MICROLOG—88-02606).

From National student conference on northern studies; Ottawa, Canada (18 Nov 1985).

Six systematic aerial surveys were conducted over the southeast Beaufort Sea in 1984. The study area extended from the 2 m isobath seaward to 7-9/10 concentration of pack-ice, and from the Alaska-Yukon border eastward to Cape Bathurst and Franklin Bay. The primary objective of the surveys was to monitor the distribution and relative abundance of bowhead whales (Balaena mysticetus) in relation to oil and gas industry activities, and in relation to oceanographic features. The abundance of bowheads generally increased throughout the open water period, from an estimated 300 during early July, to an estimated 1,500-2,400 during early-mid September. Coincident with this increase was a general shift in bowhead distribution and change in behaviour. In July, the whales were generally solitary and seen far offshore among the pack-ice. By late August and September, bowheads were more typically seen in large groups, and in nearshore waters. Feeding and socializing behaviors were commonly observed in these congregation areas. The congregation areas were located in waters characterized by: vigorous surface circulation, areas of probable upwelling, and at an oceanographic fronts marking the seaward edge of the Mackenzie River plume. Such types of oceanographic features are known to concentrate zooplankton in other regions. Congregations of bowheads seen in 1984 are believed to have been responding to prey concentrations, independent of industry activities. 16 refs., 4 figs., 1 tab.

11791 **(NP—9770191) Self-cleaning effects of soil in restricted water catchment areas with regard to different groups of pollutants. Pt. A. Establishment of a catalogue of methods and investigation of model substances. Final report.** Matthess, G.; Isenbeck, M.; Schroeter, J.; Fic, M.; Taylor, T.; Dahmke, A.; Koelling, A.; Pekdeger, A.; Reichling, J. (Kiel Univ. (Germany, F.R.). Geologisch-Palaeontologisches Inst. und Museum). 1987. 210p. (In German). NTIS (US Sales Only), PC A10/MF A01. Order Number DE89770191/JAW.

Shaking tests, infiltration tests under unsaturated conditions and transport tests in water-saturated columns, using each time the same soil materials, aquifer materials and types of groundwater, were carried out for the characterization of the mobility of the heavy metals Cd, Cu, Cr and Zn. A differentiated consideration of solution/precipitation and adsorption/desorption processes and a characterization of transport parameters was established in order to understand the geochemical interaction in acid soil/water systems having a high content of carbonate or hydrocarbonate. In the second part of the paper the transport behaviour of selected pollutants in a joint aquifer (bacteria, particles, organic an inorganic pollutants) was investigated in a test area in Canada. Dilution, dispersion and filter effects could be determined by marking the pollutants with radioactive tracers.

11792 **(ORNL/TM—11021) A biotic survey of Lovets Pond, Jackson County, Illinois.** Peterson, M.J. (Oak Ridge National Lab., TN (USA)). Dec 1988. Contract AC05-84OR21400. 76p. NTIS, PC A05/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005694/JAW.

Systematic collecting of the vascular flora, fishes, and aquatic macroinvertebrates in a natural floodplain pond ecosystem in Jackson County, Illinois, yielded 328, 17, and 93 taxa, respectively. The habitat and relative abundance of each collected specimen were recorded. Five distinct natural communities were identified in the 60-ha ecosystem and were described in detail, namely, pond, shrub swamp, true swamp, marsh, and wet-mesic flood-plain forest. With the exception of the floodplain forest all natural communities at the site were rare in the region, largely due to the extensive wetland drainage and land clearing for agricultural use. Slight disturbance to the study area appear to have had little significant impact on the site's overall natural quality. The character of the system compared favorably with the earliest known presettlement descriptions. The privately owned natural area is endangered because of the likelihood of draining and clearing for agriculture. Based on this study the site is a significant natural area of preservation. 22 refs., 5 figs.

11793 **(TR-EL—82-4/82-11-85) Species profiles: Life histories and environmental requirements of coastal fishes and invertebrates (Pacific Northwest): Pacific oyster.** Pauley, G.B.; Van Der Raay, B.; Troutt, D. (Washington Univ., Seattle (USA). Cooperative Fishery Research Unit). Sep 1988. 28p. (BR—82(11.85)). OSTI - US Fish and Wildlife Service, National Wetlands Research Center, 1010 Gause Boulevard, Slidell, LA 70458. Order Number TI89003027/JAW.

Species profiles are literature summaries of the taxonomy, morphology, range, life history, and environmental requirements of coastal aquatic species. They are designed to assist in environmental impact assessments. The Pacific oyster is found in the estuarine waters of California, Oregon, Washington, and British Columbia. It is sought both commercially and recreationally. Washington leads all other areas combined with a commercial production of 5.5 million pounds valued at $3.8 million. This is 26% of Washington State's total shellfish production value. These are very prolific ani-

mals, releasing up to 70 million eggs per year. Larvae are sensitive to a variety of environmental conditions, primarily temperature and salinity, and to pollutants including sulphite waste liquor. Growth is rapid and most noticeable in the third and fourth years. Along with other shellfish, Pacific oysters may accumulate toxin from {ital Gonyaulax cantenella} (responsible for paralytic shellfish poisoning), but they lose the toxin more rapidly than other shellfish. Optimum water temperature for adults is 20{degree}C and optimum salinities are above 20 ppt for adults. Ambient temperature is the single most critical item to breeding success in the Pacific Northwest.

5202 Chemicals Monitoring And Transport

REFER ALSO TO CITATION(S) 10707, 10708, 10848, 10897, 11179, 11730, 11920, 11926, 11931, 11963

11794 (ACUNS—88, pp 392-395) **Wetlands as waste repositories?: solute transport in peat.** Price, J.S.; Woo, M.-K. (McMaster Univ., Hamilton, Ont.). 1988. Association of Canadian Universities for Northern Studies, 130 Albert Street, Ottawa, Ont., Canada K1P 5G4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN. (CONF-8511343—; MICROLOG—88-02606).

From National student conference on northern studies; Ottawa, Canada (18 Nov 1985).

The huge wetland reserves of the temperate and subarctic zones are increasingly viewed as potential low level toxic waste repositories: thus their ability to assimilate these wastes is considered. Processes which govern the transport of a non-reactive solute through peat are examined. A series of chloride solute breakthrough experiments was carried out to determine the nature and magnitude of chloride transport in peat, using undisturbed peat columns collected in the frozen state from a southern James Bay wetland. A chloride solution was introduced into a permeameter, and the chloride content of the outflow was determined and plotted against time to produce breakthrough curves. These curves indicated that retardation of chloride occurred. Higher velocity trials produced less dispersion than those at low velocity, which is opposite to what occurs in mineral soils. Retardation of chloride was considered to be due to the temporary entrapment of the solute in closed peat pores. In higher velocity trials less time was available for inward diffusion and for the loss of solute to the closed pores. 12 refs., 4 figs., 1 tab.

11795 (ACUNS—88, pp 169-174) **Physio-chemical evaluation of water in Tundra ponds and precipitation samples from Iqaluit (Frobisher Bay), N.W.T., July 1985.** Stavinga, J. (McGill Univ., Montreal, Que.). 1988. Association of Canadian Universities for Northern Studies, 130 Albert Street, Ottawa, Ont., Canada K1P 5G4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN. (CONF-8511343—; MICROLOG—88-02606).

From National student conference on northern studies; Ottawa, Canada (18 Nov 1985).

An assessment of the susceptibility of arctic tundra ponds in the vicinity of Iqaluit (Frobisher Bay) to contamination via the atmospheric transport of pollutants was conducted during July 1985. This was achieved through the collection and analysis of surface waste samples from several large tundra ponds as well as precipitation samples from the community of Frobisher Bay. Additional samples were collected from Nettilling Lake and the surrounding area for comparative purposes. The chemical analyses of the surface water samples from Frobisher revealed low alkalinity values indicating a relatively low capacity to resist acidification. Analyses of bulk precipitation from Frobisher Bay and Nettilling Lake showed detectable levels of lead and cadmium. Lead levels were higher in Frobisher than Nettilling. It is thought that the higher lead levels are a consequence of vehicular traffic within the community itself. Local sources may account for the concentrations of cadmium measured in Frobisher Bay however, not those levels measured near Nettilling Lake. These elevated concentrations provide indirect evidence for the long range transport of cadmium. These heavy metals were not detected in the surface waters sampled; however, since these metals are insoluable, it is more probable that they would be found in the sediments. 20 refs., 3 figs., 2 tabs.

11796 (GKSS—88/E/35) **Behaviour of chlorinated hydrocarbons in suspended particulate matter of the river Elbe estuary.** Sturm, R.; Gandrass, J. (GKSS-Forschungszentrum Geesthacht G.m.b.H., Geesthacht-Tesperhude (Germany, F.R.)). 1988. 18p. (In German). Special print from Vom Wasser (1988) v. 70 p. 265-280.

In both April and October, nine water samples were collected at six different locations in the river Elbe estuary during the course of a single tidal cycle each. The samples were separated into water and seston by continuous flow centrifugation, in order to determine the concentrations of nonvolatile chlorinated hydrocarbons. The purpose of the investigations was to examine the dependence of the loadings of the suspended particulate matter with organochlorines on the tidal cycle, the course of the river and the discharge of water, and to determine the distribution of several chlorinated hydrocarbons between solution and particulates. All the chlorinated hydrocarbons analysed show similar behaviour. Correlations can also be made between the levels of chlorinated hydrocarbons in the suspended particulate matter and the concentrations of organic carbon and certain heavy metals. The distribution of organic pollutants between solution and particulates strongly depends on the chemical and physical properties of the various chlorinated hydrocarbons. At low tide more than 80% of the total content of HCB and PCB 138 respectively, and about 10% of the total content of Lindane in water, are seston bound. As a consequence of the observations, it is clear that a critical examination of the pollution situation of a river, with regard to transport processes, can only be made by comparing data from samples taken at specific times inthe tidal cycle, taking into account the fresh water discharge. Because of the comparatively high concentrations of some organic pollutants in seston, the separation of a water sample into a particulate and a dissolved phase before analysis is recommended.

11797 (INIS-BR—1386) **Copper determination in river water by spectrophotometric X-ray fluorescence.** Mansur, H.N.S.; Oliveira, I.M.F.; Mansur Netto, E.; Dolabela, L. de M.P. (Bahia Univ., Salvador (Brazil)). 1987. 2p. (CONF-8709392—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88705181/JAW.

From 2. International Environmental Chemistry Congress; Salvador, Brazil (16 Sep 1987).

11798 (IVL-B—844) **Effects of two oil refinery effluents on benthic meiofauna in mesocosms.** Liljenstroem, S.; Widbom, B.; Mattsson, J. (Swedish Environmental Research Inst., Karlskrona). Feb 1987. 38p. (In Swedish). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755770/JAW.

After six months of treatment meiofauna groups known to be sensitive to oil pollution, such as Ostracoda and Harpacticoida, showed decreasing numbers in the high dosage mesocosms, compared to the control. After fifteen months both high and low dosage mesocosms treated with effluent from refinery with cracking process showed increasing numbers in most taxa compared to the control. The conclusion of this study is that oil refinery effluents, particularly effluents originating from refineries with cracking process, at these low levels have a eutrophicating rather than a toxic effect on the marine environment. (authors).

11799 (IVL-B—884) **Project 'Partial liming - a method of preserving or attaining exploitable populations of fish in certain acidified lakes'. Final report.** Andersson, I.; Alenaes, I. (Swedish Environmental Research Inst., Goeteborg). 10 Mar 1988. 57p. (In Swedish). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88755773/JAW.

Partial liming, i.e. temporally or spatially restricted interventions, was studied in 6 acidified forest lakes on the Swedish west coast. Application of doses less than 10% of the demand for complete neutralization resulted in strong year-class recruitment for perch (Perca fluvialis) while roach (Lenciscus rutilis) needs higher pH with no occurrence of acid episodes during spring. Mercury

concentrations in fish was not reduced after partial liming. (authors).

11800 **(KTM/E-D—152) Impacts of air pollutants on surface waters with different emission scenarios.** Kaemaeri, J.; Kauppi, L. (Vesien- ja ympaeristoentutkimuslaitos, Helsinki (Finland)). (Kauppa-ja Teollisuusministerio, Helsinki (Finland). Energiaosasto). Jan 1988. 42p. (In Finnish). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755774/JAW.

This paper is the final report of a three year project studying the physico-chemical effects of atmospheric depositon on aquatic systems for different emission scenarios. A dynamic model has been constructed for describing the key processes assumed to be important in determining the long-term dynamics of surface water acidification. The The model is linked to a larger integrated structure, which allows the examination of environmental impacts resulting from different emission patterns in Europe. The principal objective of the integrated RAINS (Regional Acidification INformation and Simulation) model, developed at the International Institute for Applied Systems Analysis (IIASA), is to assist in the evaluation of policies for controlling the acidification of Europe's environment. The model for lake water acidification is applied on an extensive regional scale, to the whole of Finland. Since the input data available on a large regional scale is sparse, the model is regionalized by selecting input combinations from feasible ranges or frequency distributions. Monte Carlo techniques are then used to determine those combinations of parameters that produce the observed present-day lake acidity distribution for each individual region, when the model is driven by a specified historical deposition. The ensembles obtained is this filtering procedure for each lake region are then used for future projections. As a conclusion of the application, the need for emission control can be emphasized. Based on the model runs, the current plans to reduce sulfur emissions in Europe tend to slow down the acidification process of Finnish lakes. A further reduction in emissions would most likely improve the water quality in lakes to an acidity level that is much better able to support fish as well as other aquatic biota.

11801 **(NIVA-O—85238) Water and ion movement through a minicatchment at Risdalsheia, Norway (RAIN-project).** Hauhs, M. (Norsk Inst. for Vannforskning, Oslo). Apr 1988. 76p. NTIS (US Sales Only), PC A05. Order Number DE88755834/JAW.

At Risdalsheia (Southernmost Norway) the relation between water flow paths and streamwater chemistry through a small headwater catchment was investigated. The importance of these pathways for the interaction between soil solution and runoff chemistry was investigated by a tracer experiment with LiBr. The experiment was designed using all available information about ion transport at EGIL-catchment (hatched areas represent bare rock) in a simple model that predicted the breakthrough curve for a given tracer input. The unique facility of a roofed catchment allowed attainment and maintenance of a hydrological steady-state under highflow conditions during this tracer experiment. The chemical changes of the moving soil water due to soil/soil solution interaction mainly occured during vertical (unsaturated) infiltration. Most ions reached their runoff concentration levels after these few cm of vertical infiltration. Only the ions SO/sub 4/, NO/sub 3/, and H increased along the saturated lateral flow path. Subsurface, translatory flow and equilibrium reactions along vertical infiltration flow paths are the key processes that explain the behavior of stormflow chemistry at the EGIL-catchment. 14 figures, 9 tables, 22 refs.

11802 **(PB—89-118632/XAB) Removal of VOCs (volatile organic compounds) from drinking water by adsorption.** Speth, T.F. (Environmental Protection Agency, Cincinnati, OH (USA). Risk Reduction Engineering Lab.). Oct 1988. 43p. (EPA—600/D-88/224). NTIS, PC A03/MF A01.

The efficiency of using adsorbents to remove VOCs from potable water is discussed. The effects of variable influent concentrations, adsorption competition, natural dissolved organic matter, humic complexations, and microbial growth are evaluated. Column configurations, application methods, regeneration methods, and pretreatment options also are discussed.

11803 **(PB--89-119606/XAB) Chemical characteristics of streams in the mid-Atlantic and southeastern United States (National Stream Survey: Phase 1). Volume 1. Population descriptions and physico-chemical relationships. Final report.** Kaufmann, P.R.; Herlihy, A.T.; Elwood, J.W.; Sale, M.J.; Jager, H.I. (Environmental Protection Agency, Corvallis, OR (USA). Environmental Research Lab.). Jun 1988. 454p. (EPA—600/3-88/021A). NTIS, PC A20/MF A01.

See also PB—88-245923 and Volume 2, PB—89-119614. Errata sheet inserted.

National Stream Survey Phase I (NSS-I) field activities were conducted in the Mid-Atlantic and Southeastern U.S. in the spring of 1986 by the U.S. EPA as part of the National Surface Water Survey and the National Acid Precipitation Assessment Program. The Survey employed a probability sample of 500 stream reaches representing a regional population of 64,700 reaches portrayed as blue lines on 1:250,000 scale maps and which have drainage areas less than 155 sq km. The NSS-I design allows regional extrapolation, with known confidence, of the number and total length of reaches with specified chemical characteristics. Excluding Florida, the Southeastern subregions of the NSS-I were estimated to contain very few acidic (ANC less than 0) reaches. Acidic reaches were found primarily in lowland reaches of Florida and the Mid-Atlantic Coastal Plain and in upland reaches of the Mid-Atlantic subregions. Sulfate concentrations were markedly higher in the Mid-Atlantic than in the Southeast. Analysis of ion composition and evidence of stream acidification are presented.

11804 **(PB—89-119614/XAB) Chemical characteristics of streams in the mid-Atlantic and southeastern United States (National Stream Survey: Phase 1). Volume 2. Streams sampled, descriptive statistics, and compendium of physical and chemical data. Final report.** Kaufmann, P.R.; Herlihy, A.T.; Elwood, J.W.; Sale, M.J.; Jager, H.I. (Environmental Protection Agency, Corvallis, OR (USA). Environmental Research Lab.). Jun 1988. 625p. (EPA—600/3-88/021B). NTIS, PC A99/MF A01.

See also Volume 1, PB—89-119606. Errata sheet inserted.

National Stream Survey Phase I (NSS-I) field activities were conducted in the Mid-Atlantic and Southeastern U.S. in the spring of 1986 by the U.S. EPA as part of the National Surface Water Survey and the National Acid Precipitation Assessment Program. The Survey employed a probability sample of 500 stream reaches representing a regional population of 64,700 reaches portrayed as blue lines on 1:250,000 scale maps and which have drainage areas less than 155 sq km. The NSS-I design allows regional extrapolation, with known confidence, of the number and total length of reaches with specified chemical characteristics. Excluding Florida, the Southeastern subregions of the NSS-I were estimated to contain very few acidic reaches. Acidic reaches were found primarily in lowland reaches of Florida and the Mid-Atlantic Coastal Plain and in upland reaches of the Mid-Atlantic subregions. Analysis of ion composition and evidence of stream acidification are presented.

11805 **(PB—89-120901/XAB) Adaptation of aquatic microbial communities to pollutant stress.** Barkay, T.; Pritchard, H. (Environmental Protection Agency, Gulf Breeze, FL (USA). Environmental Research Lab.). 1988. 8p. (EPA—600/J-88/169). NTIS, PC A02/MF A01.

Pub. in Microbial Sciences, Vol. 5, No. 6, 165-169(1988).

Adaptation to biodegradation of p-nitrophenol and to volatilization of Hg^{2+} are examples of the role the process plays in removal of environmental pollutants and in maintaining active microbial communities in impacted ecosystems. A molecular mechanism of adaptation to Hg^{2+} is suggested by the enrichment of mercury resistance (MER) genes in some communities upon exposure to mercury.

11806 **(SNV—3273) Liming of lakes and watercourses. Information and consultation conference in Alvesta 4-5 November 1986.** Tullrot, A. (ed.). (National Swedish Environmental Protection Board, Solna). Mar 1987. 98p. (In Swedish). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88755854/JAW.

This is the fourth conference arranged by the National Swedish Environment Protection Board in cooperation with the

National Board of Fisheries. Main headings: -Information from the Boards, -Wetland inventory and liming, -Fauna inventories and investigations, -Remaining inventories and investigations, -More efficient administration of liming measures; the future liming, -Progress report from the Boards, -List of participants. The report presents summaries of the conference lectures. (O.S.).

11807 **(SNV—3417) Investigation of potential groundwater acidification in Sweden - using principal component analysis and regression analysis.** Andersson, I.; Stokes, J. (Royal Inst. of Tech., Stockholm (Sweden). Dept. of Land Improvement and Drainage). (National Swedish Environmental Protection Board, Solna). Feb 1988. 61p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88755862/JAW.

The purpose of the present investigation was to make statistical analyses on ground water data collected by the Geological Survey of Sweden (SGU) during the period 1968 - 1985. The intention was to trace effects due to acidification. 19 different areas from all parts of Sweden were selected for the investigation. The statistical methods used were principal component analysis and ordinary regressio analysis. The analyses showed that changes in pH worth mentioning did not occur during the period. When the alkalinity or the concentrations of calcium or sulphate changed during the period, increments were most frequent. The concentrations of magnesium were closely coupled to variations in the ground water levels. The fluctuations in time for the different ions could only be coupled to each other to a low extent. It is likely that more information could have been obtained from the material if the measurements had been made in a different way. Therefore equidistant and coordinated measurements as well as shorter intervals between measurements would be of great importance in future data collection. (authors).

11808 **(STF—21A86041) Marine pollution from offshore chemicals.** Bjoerseth, O.; Halmoe, G.; Romslo, R.; Syvertsen, T. (Selskapet for Industriell og Teknisk Forskning, Trondheim (Norway)). Apr 1986. 164p. (In Norwegian). NTIS (US Sales Only), PC A08. Order Number DE88755895/JAW.

The report analyses the influencing impact on the marine environment caused by the various chemical effluents from the offshore drilling and production. The offshore chemicals used at the Statfjord and Ekofisk fields on the Norwegian Continental Shelf are surveyed, and the volumes of effluents from the most important products are calculated. By means of GESAMP (Joint Group of Experts on the Scientific Aspects of Marine Pollution) data profiles, the toxicity of the individual products in the marine environment is evaluated. 2 figures, 14 tables.

11809 **(UCRL—21008-Vol.2-Pt.2) Evaluation of military field-water quality: Volume 2: Constitutents of military concern from natural and anthropogenic sources: Part 2: Pesticides.** Scofield, R.; Kelly-Reif, J.; Li, F.; Awad, T.; Malloch, W.; Lessard, P.; Hsieh, D. (Lawrence Livermore National Lab., CA (USA)). Jan 1988. Contract W-7405-ENG-48. 19p. NTIS, PC A09/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005520/JAW.

The purpose of this part of Volume 2 is to assess the hazard that pesticides in water pose to the health and performance of troops stationed overseas. To assess the likely exposure, the open literature was searched for reports of pesticide concentrations in water, primarily outside of the United States. Based on 15-L/d water consumption, pesticides found in concentrations causing an excess of an Acceptable Daily Intake (as proposed by the World Health Organization) were further evaluated for their toxicity and exposure potential. The assessment included information collected on quantities of pesticides used around the world. Incidents of severe contamination of water by pesticides were also investigated to identify situations that might involve serious pesticide contamination. As a result of the investigation, we found that pesticide contamination of large bodies of water (e.g., lakes, rivers, and oceans) is generally not at levels that threaten troop health or performance. Consequently, foreign water supplies need not be routinely treated specifically to remove pesticides. The greatest threat to troop health from pesticides in water appears to come from infrequent, transient occurrences of extreme contamination, particularly in small bodies of water with little potential for dilution. Because severe contaminations are known to occur, and because they would seriously affect the health and performance ability of troops, it is recommended that the military develop field techniques to detect certain classes of pesticides and selected individual pesticides. Because pesticide-contaminated water may be the only available source of drinking water, it is also recommended that the treatability of pesticides in water be investigated. 57 refs., 24 tabs.

11810 **(UCRL—21008-Vol.2-Pt.3) Evaluation of military field-water quality: Volume 2: Constituents of military concern from natural and anthropogenic sources: Part 3: Inorganic chemicals and physical properties.** Dainels, J.I.; Hirabayashi, J.M.; Crow, N.B.; Layton, D.W.; Ricker, Y.E. (Lawrence Livermore National Lab., CA (USA)). Jan 1988. Contract W-7405-ENG-48. 182p. NTIS, PC A09/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005519/JAW.

In this part of Volume 2 we identify those inorganic chemical constituents and physical properties of field-water supplies that can be present at levels that could degrade the performance of exposed military personnel. To identify these inorganic constituents and physical properties of most concern, we employed a screening methodology for comparing measured concentrations of inorganic chemicals in US and foreign surface and ground waters against estimated threshold concentrations that might produce toxic and/or organoleptic effects in humans. In order to complement the results derived from the screening comparisons and identify the physical properties of most concern in field water we examined the occurrence, toxicity, and organoleptic (e.g., color, odor, taste) data contained in review literature addressing each substance of interest. This combination of screening and survey of the review literature revealed that only arsenic, chloride, cyanide, magnesium, sulfate, total dissolved solids (TDS), and turbidity and color are likely to be of concern to military personnel consuming field water. Thus, only the inorganic substances and physical properties of water with field drinking-water-quality standards in current versions of military manuals pose potential health risks of significance to exposed troops. Consequently, up-to-date criteria documents and recommendations for field drinking-water-quality standards need to be prepared for these inorganic constituents and physical properties. We also determined that, with the possible exception of cyanide, inorganic constituents of field water will not produce performance-degrading health effects in military personnel exposed externally as a result of swimming, showering, or bathing. 95 refs., 5 tabs.

5203 Radioactive Materials Monitoring And Transport

REFER ALSO TO CITATION(S) 11071, 11139, 11773, 11909, 11958

11811 **(INIS-mf—11338) Study of kinetic controls on pyrite oxidation with application to abandonment of pyritic uranium tailings.** Cherry, J.A.; Gillham, R.W.; Nicholson, R.V. (Waterloo Univ., Ontario (Canada). Dept. of Earth Sciences). (Canada Centre for Mineral and Energy Technology, Ottawa, Ontario). Nov 1984. 76p. NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS. Order Number DE88705270/JAW.

Prepared for the National Uranium Tailings Program.

A laboratory investigation was undertaken to further clarify the controls on pyrite oxidation in carbonate-buffered solution. The behaviour of oxidation rates over extended periods of time and reaction progress was examined. The effects of variation in localized moisture content in the presence of unlimited oxygen in the gas filled pores was also studied. Flow through systems were used in which granular pyrite or silica sand and pyrite mixtures were maintained under partially-saturated moisture conditions. Gas with atmospheric levels of oxygen was also passed continuously through the samples. The results of oxidation runs that had been on-going for about 10 thousand hours were compared to predictions of a model based on shrinking core theory. Experimental evidence suggests that over the course of about one year, resistance to oxidation increases as would occur if a reaction coating were formed on the pyrite surface. When compared to the theoretical behaviour expected for such a process, only slight deviation is observed for the ex-

perimental data. Extended reaction progress of three separate grain-size fractions was simulated. Stages of vigorous oxidative treatment that were used to simulate extended reaction progress resulted in spurious behaviour of the oxidation in the alkaline solution. The results do, to some extent, reflect behaviour predicted by the shrinking core model. The effect of moisture content variation on oxidation rates was studied with the use of an unsaturated cell in which it was possible to control and maintain specified moisture content conditions while monitoring the rate of oxidation. The results of the experiment involving the unsaturated reaction cell show that the changes in local moisture content do not affect the rate of oxidation when oxygen is in continuous supply. (Abstract Truncated)

11812 **(PB—89-120786/XAB) Monitoring program for radionuclides in marketplace seafoods. Final report.** Curtis, W.R. (Office of Radiation Programs, Washington, DC (USA)). Jun 1988. 62p. (EPA—520/1-88/010). NTIS, PC A04/MF A01.

This report presents the results of a monitoring program, conducted in 1981 and 1982, by the Environmental Protection Agency (EPA) and the Food and Drug Administration (FDA) to measure concentrations of man-made radionuclides in seafoods to determine effects from previous U.S. ocean disposals of low-level radioactive wastes (LLW). Commercially-marketed seafood samples were collected from Boston, Massachusetts, Atlantic City, New Jersey and San Francisco, California. Each of these cities is near a previously-used U.S. ocean disposal site for LLW. The data obtained during this monitoring program shows that the concentrations of man-made radioactivity in seafoods sampled are below levels of public health concern. The data are considered to be of normal background level, attributable to global fallout over the oceans.

5205 Site Resource And Use Studies

REFER ALSO TO CITATION(S) 11163

11813 **(PB—89-115216/XAB) Resource document for consideration of the tulalip aquifer as a sole source aquifer.** (Environmental Protection Agency, Seattle, WA (USA). Office of Ground Water). May 1988. 34p. (EPA—910/9-88/188). NTIS, PC A03/MF A01.

In April of 1984, the U.S. Environmental Protection Agency (EPA) received a petition from the Seven Lakes Water Association (SLWA) requesting sole-source aquifer designation for the Association's service area in west central Snohomish County, Washington. The SLWA intends to utilize sole-source aquifer as one means of protecting their ground-water resource. It is referred to in the report as the Tulalip Aquifer. The report describes the characteristics of the aquifer area and evaluates the area against criteria for sole-source aquifer designation. Specific topics discussed are: (1) the boundaries of the aquifer area as proposed by EPA; (2) hydrogeologic characteristics; (3) ground-water and surface-water consumption; (4) water quality; (5) potential for contamination; and (6) the availability of economically feasible alternative sources of drinking water. The report summarizes information available to EPA as of April 1988; no additional field studies were conducted.

5206 Regulations

REFER ALSO TO CITATION(S) 11162, 11776, 11777, 11922, 11923, 11924, 11925

11814 **(PB—89-104327/XAB) Agriculture and water quality. Agriculture Information Bulletin.** Crowder, B.M.; Ribaudo, M.O.; Young, C.E. (Economic Research Service, Washington, DC (USA). Resources and Technology Div.). Aug 1988. 9p. (USDA/AIB—548). NTIS, PC A02/MF A01.

Agriculture generates byproducts that may contribute to the contamination of the Nation's water supply. Any effective regulations to ban or restrict agricultural-chemical or land-use practices in order to improve water quality will affect the farm economy. Some farmers will benefit; some will not. Most agricultural pollutants reach surface waterways in runoff; some leach through soil into ground water. Because surface-water systems and ground water systems are interrelated, farm-management practices need to focus on water quality in both systems. Modifying farm-management practices may raise production costs in some areas. Farmers can reduce runoff losses by reducing input use, implementing soil-conservation practices, and changing land use. Also at issue is who should pay for improving water quality.

11815 **(PB—89-108971/XAB) Comparative health-effects assessment of drinking-water-treatment technologies. Final report.** (Environmental Protection Agency, Washington, DC (USA). Science Advisory Board). 9 Mar 1988. 9p. (SAB-EHC—88-015). NTIS, PC A02/MF A01.

On October 8-9, 1987 the Drinking Water Subcommittee of the Science Advisory Board's Environmental Health Committee met to independently review of Office of Drinking Water report to Congress entitled Comparative Health Effects Assessment of Drinking Water Treatment Technologies. The objective of the report is to compare the health effects resulting from the use of different drinking-water-treatment technologies with those prevented by biological treatment. The Subcommittee concludes that the constraints of time and available budget, the report adequately surveys the available information on health effects pf chemicals involved in water treatment, including cost estimates. The rationale for the specific approach used in examining water-treatment processes should be articulated. The introduction should also clearly state that there is a disparity in knowledge for the various treatment techniques.

11816 **(PB—89-122253/XAB) Financing alternatives for agricultural nonpoint source pollution control programs. Final report.** Braden, J.B.; Farnsworth, R.L.; Seitz, W.D.; Uchtmann, D.L. (Illinois Univ., Urbana (USA). Dept. of Agricultural Economics). Oct 1988. 128p. NTIS, PC A07/MF A01.

The study examines mechanisms for increasing state and local spending for abatement of nonpoint source pollution from agriculture. Emphasis is on the legal feasibility and economic consequences of various funding options. The state and local funding mechanisms considered include income or sales taxes, an income tax checkoff, property taxes, special property assessments, water taxes, recreation license fees or surcharges, recreational equipment and fuel excise taxes, recreational access fees, erosion taxes, and farm chemicals taxes. Rated most highly are: property taxes or special assessments and water taxes at the local level; and water taxes and increased recreation fees at the state level. These mechanisms have a clear connection to the objective of improved water quality, would yield substantial revenues, and would be easy to administer. The remaining funding mechanisms would be too difficult to administer or have limited revenue potential.

11817 **(SNV—3515) Environmental data information system. KRUT-project. Final report.** (National Swedish Environmental Protection Board, Solna). Jul 1988. 130p. (In Swedish). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88755866/JAW.

The aim of the KRUT-project has been to construct a prototype for an environmental data system. The project has been finished with a full-scale test and an evaluation of the prototype at several Provincial Governments and communes. The final report includes proposals for a further development of the system and introduction at the Provincial Governments. Proposals for cost estimates and budget is also given. (U.W.).

53 ENVIRONMENTAL-SOCIAL ASPECTS OF ENERGY TECHNOLOGIES

5301 Social And Economic Studies

11818 **(NP—9770203) Environmental protection, energy, employment: Interdependences, fields of action at community level, strategies of action.** Schmidt, H. (Institut Wohnen und Umwelt G.m.b.H., Darmstadt (Germany, F.R.)). May 1987. 35p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE89770203/JAW.

In the first section, the effects of pollution control measures on economic growth and employment are examined: Neglected pollution control is expensive and threatens jobs; pollution control has negative and positive effects on employment; the net effect, however, is positive. The second section, energy conservation and employment, deals with the statements: greater energy consumption is no driving force for growth and no provider of work; high-power plants no longer provide more work than alternative energy systems; energy conservation saves resources and provides employment. The third section discusses programmes and instruments of an integral conservation and employment policy on a regional and municipal level. They avoid conflict between environmental and employment aims. Preventive organisation of environmental conditions and employment comprises information, management and participation aspects. (HSCH).

5302 Assessment Of Energy Technologies

REFER ALSO TO CITATION(S) 10880, 11161, 11162, 11168, 11169, 11170

11819 (ACUNS—88, pp 233-239) **Limitations on impact assessment as a tool for balanced development in the north: lessons from the Beaufort environmental assessment and review process.** Aird, R. (York Univ., North York, Ontario). 1988. Association of Canadian Universities for Northern Studies, 130 Albert Street, Ottawa, Ont., Canada K1P 5G4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN. (CONF-8511343—; MICROLOG—88-02606).

From National student conference on northern studies; Ottawa, Canada (18 Nov 1985).

Environmental impact assessment (EIA) was an institutional response to a strongly-felt need to alter the basis on which development decisions were being made. EIA can be viewed as an information-gathering exercise with an emphasis on substance, or as a decision-making process which involves open debate, thereby creating the opportunity to question the values and policies that underlie existing approaches to development. The way in which EIA is perceived defines the type and scope of problems addressed. Using the Beaufort Sea Environmental Assessment Review Process (EARP) as a case study, this paper examines three sets of limitations on EIA as a tool for balanced Northern Canadian development. One limitation was the lack of a planning context, in which assessment of a major hydrocarbon development proposal was being undertaken in spite of the absence of a policy and planning framework. Another was that despite EIA's grounding in the application of scientific principles, the lack of a sufficient data base and methodological deficiencies, including an inadequate analytic framework, meant that there were considerable constraints on scientific prediction and assessment. Finally, the context for public participation was set by the EARP panel, whose mandate did not include a number of critical long-term issues, and who operated under the implicit assumption that the question under review was not whether hydrocarbon development should proceed, but how. 21 refs., 1 fig., 3 tabs.

11820 (DOE/EIS—0136-Summ.) **Special Isotope Separation Project: Summary: Final environmental impact statement.** (EG and G Idaho, Inc., Idaho Falls (USA)). Nov 1988. Contract AC07-76ID01570. 48p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005366/JAW.

This Final EIS was prepared based on six public hearings, which were held at the request of interested organizations and individuals. The transcripts and accompanying exhibits from these hearings are available to the public as supplemental volumes (Volumes 3 through 6) to the Final EIS. Accompanying this Final EIS are DOE's responses to written comments received on the Draft EIS (Volume 2). Also included is a summary of the issues and concerns identified by the comments and how these are addressed in the Final EIS. Volumes 1 and 2 of the Final EIS have been sent to those who commented on the Draft EIS and to those who received the Draft EIS, are available to members of the public, and have been filed with the US Environmental Protection Agency (EPA). A notice of availability of the Final EIS has been published by EPA in the Federal Register. DOE will make its decision on whether to construct and operate the SIS Project and the selection of a site, if the SIS Project is to be constructed and operated, not earlier than 30 days after publication of the notice of availability. DOE will document its decision in a publicly available Record of Decision. 2 tabs.

55 BIOMEDICAL SCIENCES, BASIC STUDIES

5502 Biochemistry

REFER ALSO TO CITATION(S) 10890, 10896, 11225, 11830, 11835, 11836, 11867, 11868, 11869, 11870, 11871, 11872, 11874, 11918

11821 (DOE/ER/13901—1) **The metabolism of hydrogen by extremely thermophilic bacteria: Progress report, April 1988--December 1988.** Adams, M.W.W. (Georgia Univ., Athens (USA). Dept. of Biochemistry). Nov 1988. Contract FG09-88ER13901. 8p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005577/JAW.

Extremely thermophilic bacteria grow optimally between 80{degree} and 105{degree}C. They were discovered only recently, little is known of their physiology and biochemistry, and no enzyme has been purified from them. However, they have enormous potential in energy conversions and the production of fuels and chemicals. In this project we are investigating the metabolism of molecular hydrogen (H_2) by five extremely thermophilic bacteria, selected on the basis of their remarkable physiology and remote phylogenetic positions. Two have been isolated from deep sea hypothermal vents. Our objectives are to grow these organisms on a large scale in vitro and purify their hydrogenases, the enzyme responsible for catalyzing H_2 activation and H_2 production, and related redox proteins. Their molecular and catalytic properties will then be determine by biochemical and spectroscopic techniques. The long term goal is to assess the biotechnological potential of these enzymes. 2 refs.

11822 (DOE/ER/60582—2) **[Techniques for determining the physical structure of entire chromosomes]: Progress report, November 1, 1987--November 1, 1988.** Smith, C.L. (Columbia Univ., New York (USA). Coll. of Physicians and Surgeons). 1988. Contract FG02-87ER60582. 5p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004867/JAW.

Over the last year we have focused on refining the chromosome 21 Not I and Mlu I megabase fragment information accumulated with various single copy clones and on developing various end strategies to link up different physical regions. This work involves multiple strategies, including aligning the genetic and physical map and developing PFG size standards. 30 refs.

11823 (DOE/ER/60636—1) **Differentiation and carcinogenesis: An integrated multilevel study of mechanisms from molecules to man: Progress report, 1 February 1988--31 January 1989.** Ts'o, P.O.P. (Johns Hopkins Univ., Baltimore, MD (USA). School of Hygiene and Public Health). Sep 1988. Contract FG02-88ER60636. 34p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004941/JAW.

Cellular studies focuses on the investigation of cellular differentiation related to carcinogenesis: (1) myoblast progenitor cells and their normal differentiation, (2) how the normal differentiation sequence and/or mechanism is altered following exposure to carcinogen and (3) how the state of differentiation (i.e., degree of restriction of genetic potential) affects the cell's susceptibility to carcinogenic insult. An established diploid, Syrian hamster (SH) myoblast progenitor cell line is being used for these studies. A series of cDNA probes for muscle proteins has been obtained for evaluating the molecular biological aspects of differentiation after carcinogen treatment (MNNG). Molecular biology studies focuses on three areas: (1) DNA replication in SH cells transiently exposed to hydroxyurea; (2) expression of the intracisternal A particle (IAP) endogenous retrovirus genes over the lifetime of mouse and SH; and (3) development of methodology to detect and characterize DNA rearrangement and genome reorganization process. In the third

area, emphasis has been on the development of a general method for detecting rearrangements in the bacterial genome and for monitoring mammalian genome rearrangement involving sequences neighboring mid-repetitive sequences (IAP). Molecular cytology focused on the establishment of a "computerized microscopic imaging system" for quantitative measurement of immunofluorescence. 95 refs.

11824 **(DOE/FTR—9005119) [Information on the newly discovered cell surface receptor for urokinase, experiments designed to characterize its function, and latest research on plasminogen activation, Copenhagen, Denmark, and Amsterdam, The Netherlands, April 30--July 31, 1988]: Foreign trip report.** Mangel, W.F. (Brookhaven National Lab., Upton, NY (USA)). 20 Sep 1988. Contract AC02-76CH00016. 13p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005119/JAW.

The purpose of the trip was to learn about the newly discovered cell surface receptor for urokinase and to begin experiments designed to characterize its function. The following is a description of the background for this project, and its objectives: The fibrinolytic enzyme system is involved in a wide variety of extracellular physiological processes, from degrading fibrin blood clots to tissue remodeling to cell migration. The regulatory mechanisms by which fibrin blood clots are dissolved are beginning to be understood. Much less understood are the regulatory mechanisms by which tissue is remodeled or by which cells migrate. This proposal outlines experiments whose objective is to begin to understand the regulation of fibrinolytic activity at the cell surface and what role this may play in tissue remodeling and cell migration. Many normal and abnormal physiological processes are mediated by the fibrinolytic enzyme system. One of its major functions is the dissolution of fibrin blood clots, and, if this does not occur, heart attack or stroke may ensue. Among other physiological processes, the fibrinolytic enzyme system has been implicated in defensive reactions by macrophage which, upon activation, exhibit enhanced levels of surface fibrinolytic activity.

11825 **(EPRI-EA—6072) Innovative approaches in cancer risk assessment: Proceedings.** (Electric Power Research Inst., Palo Alto, CA (USA); Clement Associates, Inc., Ruston, LA (USA)). Nov 1988. 214p. (CONF-8603254—). Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI89004099/JAW.

From EPRI workshop on innovative approaches in cancer risk assessment; Denver, CO, United States (1 Mar 1986).

The workshop was conducted to promote an exchange of ideas concerning new approaches for the use of data in risk assessment methodology. Presentors explored the limitations and problems of existing methodologies but focused on the development and use of innovative approaches to risk assessment. Specific discussions centered on: current methodology in quantitative risk assessment; physiologically-based pharmacokinetic modelling in the risk assessment process; in vitro mutagenicity screening versus animal and human studies; covalent adducts and its role in mutagenesis, carcinogenesis, and immunotoxicity; human variability in specific parameters and its implication for risk assessment; non-neoplastic lesions and their potential as early indicators of carcinogenesis; statistical analysis of Salmonella test data and its comparison to animal cancer tests results; structure-activity relationships; and epidemiological uses of negative data. The accomplishments of this workshop were three-fold: (1) important facets of carcinogenesis that often are not adequately considered in current approaches to quantitative risk assessment were reviewed; (2) data currently available on these facets were reviewed, and (3) quantitative and qualitative approaches to the incorporation of this data into risk assessment methodologies were described. Individual reports were processed separately for the data base.

11826 **(LBL—26163) Fluorescence studies of cyanobacterial phycobiliproteins: I. Spectroscopy of allophycocyanin core complexes. II. Spectroscopy of two phycobilisome core insertion mutants.** Maxson, P. (Lawrence Berkeley Lab., CA (USA)). Oct 1988. Contract AC03-76SF00098. 114p. NTIS, PC A06/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004656/JAW.

The work described here relates to the mechanisms governing energy transfer in the core polypeptides of the cyanobacterial phycobilisome. Two approaches are represented: measurements were made on isolated core components for which a great deal of structural information is available; and the fluorescence properties were characterized for the whole phycobilisome from two phycobilisome core insertion mutants. 130 refs.

11827 **Progress toward understanding the molecular details and consequences of IgE-receptor crosslinking.** Baird, B.; Erickson, J.; Goldstein, B.; Kane, P.; Menon, A.K.; Robertson, D.; Holowka, D. (Cornell Univ., Ithaca, NY (USA)). pp 41-59 of Theoretical immunology, Part 1: Part 1, Proceedings. Perelson, A.S. (ed.). Redwood City, CA; Addison-Wesley Publishing Co., Inc. (1988).

From Theoretical immunology workshop; Santa Fe, NM, USA (1 Jun 1987).

Little is known about the mechanism by which the aggregation of immunoglobulin receptors at the cell surface stimulate the release of histamine in allergic responses. This study will briefly summarize the way in which IgE binds to the receptor and the way in which clustered IgE-receptor complexes interact with other cellular structures to generate a transmembrane signal. Greater emphasis is placed on the way in which IgE-receptor complexes bind multivalent antigen and are cross-linked.

11828 **Two distinct states of crosslinked IgE receptors that may trigger and terminate secretion from RBL-2H3 mast cells.** Oliver, J.M.; Seagrave, J.C.; Stump, R.F. (Univ. of New Mexico, Albuquerque, (USA)). pp 60-82 of Theoretical immunology, Part 1: Part 1, Proceedings. Perelson, A.S. (ed.). Redwood City, CA; Addison-Wesley Publishing Co., Inc. (1988).

From Theoretical immunology workshop; Santa Fe, NM, USA (1 Jun 1987).

In mast cells and basophils, the crosslinking of cell surface IgE receptors is the first of a series of events leading to the release of inflammatory mediators and vasoactive amines from granules. The recent development of several permanent mast cells lines has provided investigators with large numbers of cells to analyze the molecular mechanisms of this secretory response. One of the best characterized is RBL-2H3, a line of rat leukemia cells that provides an in vitro model for the study of mucosal mast cells. The experiments described here address the mechanisms that couple (and uncouple) IgE receptor crosslinking to the activation of biochemical, biophysical and functional responses in RBL-2H3 cells. These data form the basis of a new model for the control of secretion from mast cells. Its central hypothesis is that crosslinked IgE receptors can exist in two distinct states at the cell surface, one that can interact with transducer and effector moieties to trigger secretion, and one that is either inactive of can inhibit secretion.

11829 **Hydrophilicity, solvent accessibility and location of antigenic determinants in proteins.** Klein, P.; Somorjai, R.L. (National Research Council of Canada, Ottawa, Ontario). pp 147-158 of Theoretical immunology, Part 1: Part 1, Proceedings. Perelson, A.S. (ed.). Redwood City, CA; Addison-Wesley Publishing Co., Inc. (1988).

From Theoretical immunology workshop; Santa Fe, NM, USA (1 Jun 1987).

Solvent accessibility (a property derived from protein tertiary structure) and hydrophilicity of protein segments (dependent on the amino-acid sequence only) and among the properties thought to be correlated with the location of protein antigenic determinants. The authors discuss these properties in the context of protein structure prediction, and present some quantitative results on the prediction of a region in the folded protein (defined by accessibility values) from sequence properties such as hydrophilicity and charge.

5503 Cytology

REFER ALSO TO CITATION(S) 11823, 11824

5504 Genetics

REFER ALSO TO CITATION(S) 10899, 11863

11830 **(DOE/ER/60408—3) Correlation of chromosome patterns in human leukemic cells with exposure to chemicals and/or radiation: Comprehensive progress report, January 1986--June 1988.** Rowley, J.D. (Franklin McLean Memorial Research Inst., Chicago, IL (USA)). Jun 1988. Contract FG02-86ER60408. 19p. NTIS, PC A03/MF A01 - OSTI. Order Number DE88012768/JAW.

I purchased one of the few available prototypes of the pulse field gel electrophoresis (PFGE) apparatus. We used PFGE and its various modifications to map the human Abelson protooncogene (ABL) and to show that the two alternative first exons (Ia and Ib) are separated by at least 200 kilobases (kb). This has provided the first evidence that alternative splicing from exon Ib to the common splice acceptor site (exon II) could occur over such very large distances. We are actively using vertical field gel electrophoresis, a modification of PFGE, for mapping various DNA probes on chromosome 5. Another major advance has been the development of the polymerase chain reaction (PCR). We are currently using this to define the breakpoints in the BCR gene in the 9; 22 translocation in chronic myeloid leukemia (CML) and in Ph^1-positive acute lymphoblastic leukemia (ALL). I had expected to be able to describe major progress in cloning the chromosome translocation breakpoints in ANLL, and this has not occurred. Our laboratory knows how to solve the problem. We successfully cloned a new translocation breakpoint in B cell chronic lymphatic leukemia involving Nos. 14 and 19. 22 refs., 2 figs., 5 tabs.

11831 **(PB—88-160783) Mapping our genes: Federal genome projects: How vast? How fast?: Volume 1, Contractor reports.** Reisher, S.R.; Friedmann, T.; Glover, J.; Heilbron, J.L.; Judson, H.F. (Office of Technology Assessment (U.S. Congress), Washington, DC). Feb 1988. 283p. NTIS, PC A13. Order Number DE88013479/JAW.

This report contains contractor contributions solicited by the US Office of Technology Assessment in support of its recommendations for federal organization of the human genome project. The individual reports contained herein are entitled: Bibliometric analysis of work on human gene mapping; Medical implications of extensive physical and sequence characterization of the human genome; Mapping the human genome: Some implications; Mapping and sequencing the human genome: Considerations from the history of particle accelerators; Mapping the human genome: Historical background; Long-term implications of mapping and sequencing the human genome: Ethical and philosophical implications. Each report is also separately abstracted and indexed for the Energy Data Base. (DT)

11832 (PB—88-160783, pp 1-41) **Bibliometric analysis of work on human gene mapping.** Reisher, S.R.; Albert, M.B. Feb 1988. NTIS, PC A13. Order Number TI88013479/JAW.

In Mapping our genes: Federal genome projects: How vast? How fast?: Volume 1, Contractor reports.

This project assesses the progress and advancement of mapping and/or sequencing the human genome. Three major approaches were used in the assessment. Identification and assessment of the growth of the relevant scientific literature were carried out by keyword searches. The development of specific indicators, e.g., number of genes mapped, number of nucleotide sequences analyzed, etc., were measured. Important methods and strategies for mapping and/or sequencing the human genome were identified. Results are presented in the main body of this report. 6 figs., 13 tabs.

11833 (PB—88-160783, pp 41-59) **The human gene map.** Sparkes, R.S. Feb 1988. NTIS, PC A13. Order Number TI88013479/JAW.

In Mapping our genes: Federal genome projects: How vast? How fast?: Volume 1, Contractor reports.

An overview of the genetic mapping of the human genome is presented. After a brief history of genetic mapping, the methods used to map genes to specific sites on individual chromosomes are described. Other topics developed herein include human chromosome fragile sites; genetic mapping in human cancer; clinical human gene map; useful clinical mapping relationships; and future developments. 36 refs., 7 tabs.

11834 (PB—88-160783, pp 108-159) **Mapping the human genome: Some implications.** Glover, J. Feb 1988. NTIS, PC A13. Order Number TI88013479/JAW.

In Mapping our genes: Federal genome projects: How vast? How fast?: Volume 1, Contractor reports.

This report discusses ethical issues arising out of the mapping and sequencing of the human genome. Some issues arise from the possible applications to which the knowledge could be put while other issues arise from the knowledge itself, independent of its particular applications. The report deals with these issues separately. Part One is concerned with what has most caught public attention: the sometimes startling "eugenic" applications to which the knowledge might be put. Part Two looks at the issues raised by the knowledge itself, independent of its applications: at the effects of the new genetic knowledge on our attitudes to ourselves and to other people. 13 refs.

11835 (PB—88-160783, pp 160-179) **Mapping and sequencing the human genome: Considerations from the history of particle accelerators.** Heilbron, J.L.; Kevles, D.J. Feb 1988. NTIS, PC A13. Order Number TI88013479/JAW.

In Mapping our genes: Federal genome projects: How vast? How fast?: Volume 1, Contractor reports.

A large federal project to map and sequence the human genome seeks to stimulate the ongoing development of sequencing technology, to generate, eventually, a sequence of the complete human genome. Our reading of the relevant history of particle accelerators suggests that for the next five to ten years it would be wise to pursue these several goals by mixed and multiple means designed to take advantage of the pluralist forces of scientific and technological ambition already manifest in the field. A loosely coordinated program under federal grants or awards and peer reviewed be administered to provide investigators at non-profit institutions with the means to work on mapping and the development of sequencing technology, subject to federal regulations applicable to whatever patentable technologies may be developed under such grants. A federally owned and managed institute should be established to map and sequence data base, to which federal grantees would be required to submit map and sequence data in standardized, annotated form. A suitable entity should be created to oversee the data base. This NBBS should have the authority to buy sequence data from research institutions without federal grants and to contract for the production of such data and to undertake sequencing on its own as a secondary activity if and when the trend of the technology seems to warrant it. 35 refs.

11836 (PB—88-160783, pp 180-235) **Mapping the human genome: Historical background.** Judson, H.F. Feb 1988. NTIS, PC A13. Order Number TI88013479/JAW.

In Mapping our genes: Federal genome projects: How vast? How fast?: Volume 1, Contractor reports.

The historical development of genetics is related from Darwin to Human Genome Mapping. The contributions of Gregor Mendel, August Wiesmann, Archibald Garrod, Walter Sutton, Alfred H. Sturtevant, Herman Muller, Barbara McClintock, Max Delbrueck, Sewall Wright, George Beadle, Frederick Sanger, Erwin Chargaff, Salvador Luria, Jacques Monod, Francois Jacob, James Watson, Francis Crick, Seymour Benzer, David Baltimore, Walter Gilbert, James Gusella and others are described and related to the development of molecular biology. 48 refs.

11837 (PB—88-160783, pp 236-306) **Long-term implications of mapping and sequencing the human genome: Ethical and philosophical implications.** Lappe, M. Feb 1988. NTIS, PC A13. Order Number TI88013479/JAW.

In Mapping our genes: Federal genome projects: How vast? How fast?: Volume 1, Contractor reports.

A project to map and sequence the entire human genome would be the most ambitious undertaking in human biology. On completion, the exact location and sequence of the nucleotides that make up the 3 billion units of human DNA would be assembled, catalogued, and maintained. Ethical issues will arise in the course of deciding what priority to give the project and what level of resolution (broad map, linkage group picture, full sequence) is most appropriate given our current level of ability. More profound ethical questions will be posed by the possible applications of the data as genetic data reveal more about the underlying basis for human disease, ability and social interaction. Questions about personal liberty, privacy, "right to know" and societal versus individual prerogatives to use or sequester genetic information are among the most important. A full genomic picture will of necessity raise anew the desirability of using genetic knowledge and its control to shape the future of human society. The complexity and urgency of resolving these and related issues will increase in proportion to the stage of development of the project. 87 refs.

5505 Metabolism

REFER ALSO TO CITATION(S) 10891, 11707, 11754

11838 **(DOE/ER/60575—1) [Integration of experimental and modeling approaches in the unmanaged ecosystem research plan]: Performance report, September 15, 1987--September 14, 1988.** Strain, B.R. (Duke Univ., Durham, NC (USA). Dept. of Botany). 19 Dec 1988. Contract FG05-87ER60575. 4p. NTIS, PC A02/MF A01 - OSTI. Order Number DE89005230/JAW.

In year 1 of this award three phases of research were initiated in an investigation of physiological adaptations in plants grown for long periods in enhanced CO_2 levels. The objectives of this research are: to improve the empirical data base of the effect of CO_2 and climate variables on plants and ecosystems, paying particular attention to mechanisms of photosynthetic decline and the physiological controls of whole-plant growth; and to contribute new information to an integrated modeling approach for examining the effects of different CO_2 and multiple environmental factors on whole plants and ecosystems data will be provided to the PRECO and SERECO-type models. 9 refs.

5506 Medicine

REFER ALSO TO CITATION(S) 11825, 11951

11839 **(BNL—41994) Clinical aspects of accidents resulting in acute total body irradiation.** Cronkite, E.P. (Brookhaven National Lab., Upton, NY (USA)). 1988. Contract AC02-76CH00016. 7p. (CONF-8810113—1). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004517/JAW.

From The medical basis for radiation accident preparedness II; Oak Ridge, TN, USA (20 Oct 1988).

That the management of whole body radiation injury involves: (1) watchful waiting, (2) observation of the hematologic parameters, (3) use of antibiotics, platelet red cell and possibly granulocyte transfusions, (4) administration of hemopoietic molecular regulators of granulopoiesis, and (5) bone marrow transplantation as the last line of defense. The clinical indication for the preceding will not be discussed, since this will be a subject of later speakers in this conference. Certainly, if a radiation casualty is fortunate enough to have an identical twin, a marrow transplant may be lifesaving and certainly can do no harm to the patient, and there is little risk to the donor.

11840 **(CONF-8809225—1) Transfer of radionuclides to animals: An historical perspective of work done in the United States.** Richmond, C.R. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 16p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004018/JAW.

From Workshop on the transfer of radionuclides to livestock; Oxford, UK (5 Sep 1988).

This document describes historical aspects of the use of radionuclides in animals, particularly in the United States. (TEM)

11841 **(EGG-M—03088) Mass spectral investigations of boron neutron capture therapy (BNCT) agents.** Miller, D.L.; Peterson-Wright, L.J. (EG and G Idaho, Inc., Idaho Falls (USA)). 1988. Contract AC07-76ID01570. 2p. (CONF-8806199—6). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005180/JAW.

From 36. ASMS annual conference on mass spectrometry and allied topics; San Francisco, CA, United States (5 Jun 1988).

We examined the use of mass spectrometry incorporating fast atom bombardment ionization to determine if the potential existed for the development of a HPLC FAB/MS analytical procedure utilizing the new continuous-flow FAB inlet. All experiments were conducted on a KRATOS MS890 equipped with an 8 kV MS50-type FAB source. The MS890 was equipped with an Ion Tech (11NF) saddle field ion gun and xenon was used as the FAB gas. Initial experiments using BSH were conducted in both positive and negative ion modes using a variety of FAB matrices. Positive ion experiments were discontinued when no peaks indicative of the compound of interest were observed. The positive ion spectra were dominated by peaks arising from sodium reacting with the various matrices used. Experiments conducted in the negative ion mode proved to be much more productive. A variety of matrices were tested with BSH. These matrices included glycerol, thioglycerol, 3-nitrobenzyl alcohol, triethanolamine, and PEG-600. No peaks indicative of the BSH compound were observed when glycerol was used as the matrix, even though the BSH was readily soluble. For the remainder of the matrices tested, good solubility of the BSH was also observed, as well as peaks using BSH containing the natural isotopic abundance of boron (approximately 20% ^{10}B and 80% ^{11}B). When examined using thioglycerol as the matrix, a cluster of peaks indicative of boron was observed with the most intense peak occurring at M/Z 197.

11842 **(EGG-M—88104) The effect of ionizing radiation on the blood-brain-barrier (BBB): Considerations for the application of Boron Neutron Capture Therapy (BNCT) of brain tumors.** Dorn, R.V. III; Spickard, J.H.; Griebenow, M.L. (EG and G Idaho, Inc., Idaho Falls (USA)). 1988. Contract AC07-76ID01570. 8p. (CONF-8802102—2). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005177/JAW.

From BNL BNCT workshop; Upton, NY, USA (1 Feb 1988).

All methods of Boron Neutron Capture Therapy (BNCT) in use or envisioned for treatment of brain tumors have an element of ionizing radiation (incident and induced). This paper reviews data on the effects of ionizing radiation on the blood-brain-barrier (BBB) and the blood-tumor-barrier (BTB) and the potential impact of the effects on the delivery techniques of BNCT. The objectives are: review the available technique for BNCT of brain tumors; review the literature on experimental and human studies regarding the effects of ionizing radiation on the BBB; discuss the impact of these effects on the fractionization question for BNCT; and draw conclusions from that information. 22 refs., 4 tabs.

11843 **(EGG-M—88105) Computerized axial tomographic and magnetic resonance imaging scan follow-up of two patients after boron neutron capture therapy for Glioblastoma Multiforme.** Marano, S.R.; Spickard, J.H.; Griebenow, M.L. (EG and G Idaho, Inc., Idaho Falls (USA)). 1988. Contract AC07-76ID01570. 11p. (CONF-8802102—3). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005285/JAW.

From BNL BNCT workshop; Upton, NY, USA (1 Feb 1988).

Using computed tomography (CT) and magnetic resonance imaging (MRI), we are following a 30-year old, white female and a 64-year old, white female and a 64-year old, white male, both with biopsy-proven Glioblastoma Multiforme, from their preoperative through post-operative stages and pre- and post-BNCT treatment. The images visually demonstrate the evolving changes in the tumor and surrounding cortex. These patients were treated by Hiroshi Hatanaka of Teikyo University, at the Musashi Institute of Technolo-

gy (MIT) reactor is a 100 kW Triga-II facility that has been used by Hatanaka for many years for BNCT therapy. 7 figs.

11844 **(INIS-BR—1347) Imediate and long term therapeutic results from association of chemotherapy and radiotherapy in head neck cancer.** Monti, C.R. (Hospital Municipal de Campinas, SP (Brazil)). 1987. 9p. (In Portuguese). NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS. Order Number DE88705268/JAW.

A analysis of 922 cases of head and neck cancer observed from March of 1977 to March of 1987 is presented. The actual position of the combined treatment of radiotherapy and chemotherapy is reported.

11845 (INIS-mf—11332, pp 37) **Evaluation of a selective boron absorption in liver tumors.** Altieri, S.; Braghieri, A.; Fossati, F. and others. (Pavia Univ. (Italy)). 1988. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705189/JAW. (CONF-8809213—).

From IAEA Meeting: 10th European TRIGA users' conference; Vienna, Austria (14 Sep 1988).

11846 (INIS-mf—11339, pp 86-91) **Interdisciplinary view of the role of radionuclide skeletal examination in bone metastases patients.** Kolar, J. (Institut pro Dalsi Vzdelavani Lekaru a Farmaceutu, Prague (Czechoslovakia)). Dec 1987. (In Czech). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88705271/JAW. (CONF-8610369—).

From 2. congress of Czechoslovak Society of Nuclear Medicine and Radiation Hygiene; Bratislava, Czechoslovakia (28 Oct 1986).

The current role and potential are briefly characterized of especially radionuclide examinations in screening for skeletal metastases of malignant neoplasms. The potential is compared of such examinations and of the most common diagnostic technique, i.e., X-ray imaging. The benefits and constraints are explained for each technique. X-ray examinations are unsuitable as screening for skeletal metastases; the results are not reliable, the procedure is economically demanding, requires money and results in high radiation burden. In selected cases, radionuclide skeletal examination can be used as a screening method. (author). 4 figs., 14 refs.

11847 (INIS-mf—11339, pp 92-95) **Estimated clinical need of skeletal scintiscanning.** Hoffmannova, E. (Okresni Ustav Narodniho Zdravi, Kolin (Czechoslovakia). Oddeleni Nuklearni Mediciny). Dec 1987. (In Czech). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88705271/JAW. (CONF-8610369—).

From 2. congress of Czechoslovak Society of Nuclear Medicine and Radiation Hygiene; Bratislava, Czechoslovakia (28 Oct 1986).

A statistics is shown of the incidence of malignant neoplasms metastasing in bones, for the years 1964-1984. The need of scintiscanning is discussed with respect to the patient's condition and the type of tumor. Scintiscanning of non-tumorous skeletal affections in the period under study was most frequently performed in patients with the vertebrogenous pain syndrome and with nonspecific symptoms. In spite of the growing number of scintiscanning examinations in the years 1979-1985, the complete coverage of clinical needs is conditional on instrumentation (i.e., the number of gamma cameras), the supply of technetium generators and the availability of the optimum radiopharmaceutical, i.e., methylene diphosphonate. (E.S.). 4 figs., 1 tab., 6 refs.

11848 (INIS-mf—11339, pp 96-99) **Diagnosis of bone metastases of malignant tumors.** Bek, V.; Kolar, J.; Hausner, P.; Stepan, J.; Hermanska, Z.; Janko, L.; Konopasek, B.; Novy, F.; Vosecky, M. (Karlova Univ., Prague (Czechoslovakia). Fakulta Vseobecneho Lekarstvi; Institut pro Dalsi Vzdelavani Lekaru a Farmaceutu, Prague (Czechoslovakia)). Dec 1987. (In Czech). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88705271/JAW. (CONF-8610369—).

From 2. congress of Czechoslovak Society of Nuclear Medicine and Radiation Hygiene; Bratislava, Czechoslovakia (28 Oct 1986).

922 patients with malignant tumors were subject to long-term follow-up. Radionuclide skeletal examinations were performed using /sup 85/Sr and technetium-labelled pyrophosphate. All data obtained was computer-processed. The specificity of the radionuclide examinations ranged between 75 and 80%. Discussed in greater detail are the results of a prospective study of 180 female patients with stage II mammary gland carcinoma. Following mastectomy, comprehensive examination was carried out to diagnose bone and bone marrow metastases. The probability of bone dissemination of the carcinoma for positive radionuclide tests was found to be 75%. In a small number of patients, cytological examination was also performed of sternal puncture specimens, and cytomorphological examinations of nontargetted trepanobiopsis specimens. It was found that the finding of tumor cells in the bone marrow may be the only signal of the metastasis of the tumor with all other findings negative. (E.S.). 10 tabs.

11849 (INIS-mf—11339, pp 100-103) **Role of isotope skeletal examination in comprehensive diagnosis of mammary gland carcinoma.** Svobodova, M.; Kudlickova, Z.; Ilievova, M.; Studynka, M. (Vyzkumny Ustav Klinicke a Experimentalni Onkologie, Brno (Czechoslovakia)). Dec 1987. (In Czech). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88705271/JAW. (CONF-8610369—).

From 2. congress of Czechoslovak Society of Nuclear Medicine and Radiation Hygiene; Bratislava, Czechoslovakia (28 Oct 1986).

Initial scintiscanning of the skeleton was performed in 1,134 patients with recent diagnosis of mammary gland carcinoma. The clinical stage was reassessed in 18.5% of patients following comparison of positive scintigraphic findings with X-ray examination results. In the group of patients in which ablation of the mamma was performed outside the authors' institute, bone metastases were shown in 24.09 per cent. Thus, the group was a priori inoperable and management should have started with systemic therapy. It is concluded that skeletal scintiscanning of mammary gland carcinoma patients has its unquestionable place in the examination scheme which also consists of thorough history, clinical, biochemical and X-ray examinations. The initial examination also serves as basic information for future follow-up. (author). 3 tabs., 12 refs.

11850 (INIS-mf—11339, pp 103-109) **Role of skeletal scintiscanning in diagnosis of lung carcinoma.** Santora, J.; Karas, A.; Fischerova, H.; Kana, J.; Pacina, V.; Urban, S. (Zavodni Ustav Narodniho Zdravi Uranoveho Prumyslu, Pribram (Czechoslovakia)). Dec 1987. (In Czech). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88705271/JAW. (CONF-8610369—).

From 2. congress of Czechoslovak Society of Nuclear Medicine and Radiation Hygiene; Bratislava, Czechoslovakia (28 Oct 1986).

History with physical examination, whole-body skeletal scintiscanning and bone X-ray imaging were tested for efficacy of early diagnosis of bone metastases and/or disease reversal in a group of 156 lung cancer patients, within primary diagnosis and disease follow-up. The superiority was shown of whole-body scintiscanning both for early diagnosis of bone metastases and the sensitivity of determining the progress of the disease. An algorithm was proposed of inclusion of the method in the diagnostic process. (author). 10 tabs., 9 refs.

11851 (INIS-mf—11339, pp 109-111) **Radioimmunodetection of tumors using labelled antibodies in experiment.** Koprivova, H.; Novak, F.; Dvorak, P.; Pouckova, P.; Glagolicova, A.; Seblova, J.; Duskova, J.; Dienstbier, Z. (Karlova Univ., Prague (Czechoslovakia). Fakulta Vseobecneho Lekarstvi). Dec 1987. (In Czech). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88705271/JAW. (CONF-8610369—).

From 2. congress of Czechoslovak Society of Nuclear Medicine and Radiation Hygiene; Bratislava, Czechoslovakia (28 Oct 1986).

The experiments were performed using genetically athymic mice (BALB/C, nu/nu) with xenotransplants from human neoplasms. Three types of rectum adenocarcinoma, the human HeLa tumor line and the bladder tumor T-24 line were transplanted to

the mice. Polyclonal sheep and rabbit antibodies were prepared and monoclonal mouse antibody 7E9 imported from Sweden was tested. In all experiments, the antibodies were labelled with /sup 131/I and were i.v. injected. Scans were performed at certain time intervals. Radioactivity distribution in the blood and the individual organs was studied five to six days following the application of the antibodies. The results obtained using the antibodies are discussed and the problems of radioimmunodetection of tumors are outlined. (E.S.).

11852 (INIS-mf—11339, pp 111-119) **Radionuclide lymphography with /sup 99m/Tc-sulfur colloid in limb lymphedema.** Lebloch, D.; Benda, K.; Horak, Z.; Havlickova, H. (Fakultni Nemocnice s Poliklinikou, Brno (Czechoslovakia). Oddeleni Nuklearni Mediciny). Dec 1987. (In Czech). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88705271/JAW. (CONF-8610369—).

From 2. congress of Czechoslovak Society of Nuclear Medicine and Radiation Hygiene; Bratislava, Czechoslovakia (28 Oct 1986).

Since February 1985, indirect radionuclide lymphography (RNL) using /sup 99m/Tc-Lymphoscint (Solco, Basel) was performed in 50 patients with disturbed lymphatic circulation of the limbs or with suspect disturbance, aiming at specifying the edema diagnosis. 76 lower and 24 upper limbs were examined. The radiopharmaceutical was applied subcutaneously in a dose of 150 MBq for a lower limb and of 75 MBq for an upper limb. Transit time was monitored using a scintillation camera. At minutes 30 and 60, pictures were made of the lymphatic vessels of the limb and of lymphatic nodes. The results showed that lymphatic circulation disturbances were characterized by extension of the transit time, by retention of the radiocolloid in the limb lymphatic vessels, and by the reduction or failure of its cumulation in regional and superior nodes. In the primary lymphedema the radiocolloid was retained in the distal limb vessels while in the secondary lymphedema the radiocolloid tended to congest in front of the vessel obstruction, most frequently in proximal parts of the limb, before the regional nodes where activity was missing. In the more advanced stages of the lymphedema, at total lymphatic circulation failure, the radiopharmaceutical was retained in the site of injection and the type of lymphedema could not be identified. In the edema of extremities caused by other reasons, such as in the edema of the vein, the RNL finding may be normal or the radiocolloid transport may be accelerated (i.e., a shorter transit time). It is concluded that radionuclide lymphography using /sup 99m/Tc-sulfur colloid is a technically simple, ready, noninvasive examination providing valuable information on the lymphatic circulation function and to a certain degree on the morphology of the lymphatic vessels. It thus finds a significant application as a complementary examination in the diagnosis and the differential diagnosis of lymphedema and the edema of limbs in general. (author). 7 figs., 18 refs.

11853 **(INIS-mf—11869) Skeletal changes of progressive systemic scleroderma (PSS), of exclusive Raynaud phenomenon and of circumscript scleroderma in a gamma camera scintigraph.** Ulbrich, T. (Frankfurt Univ. (Germany, F.R.). Fachbereich Humanmedizin). 30 Apr 1987. 94p. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88756362/JAW.

The bases of this study are the skeletal scintigraphs of altogether 34 patients with the three forms of scleroderma mentioned in the title. The PSS shows a polytropic, symmetric distribution pattern, the exclusive Raynaud's phenomenon shows a basic skeleton which is unchanged in contrast to circumscript scleroderma, with which also the larger joints are relatively more frequently attacked than the little ones. As a result of high sensitivity skeletal scintiscanning makes possible an early recognition of osseous changes and is there with superior to X-radiology and should then see an increased use for the clarification of the diagnosis of arthropathy in scleroderma. (TRV).

11854 **(INIS-mf—11874) Role of radiopharmaceutical renal function studies in the medical surveillance of patients with transplanted kidneys.** Ernst, S. (Tuebingen Univ. (Germany, F.R.). Medizinische Fakultaet). 1983. 88p. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88756367/JAW.

In a study group of 35 patients having received a total of 37 kidneys 204 renal function scintiscans were obtained following administration of 99mTc DTPA and analysed with regard to the question as to whether radiopharmaceutical investigations using a gamma camera are a useful auxiliary tool to detect and diagnose functional disorders in the transplant that occur soon after surgery. In all of 13 patients showing complications in the form of prolonged anuria or oliguria during a period of up to 14 days following surgical intervention, the renal function scintiscans either permitted as firm diagnosis to be established or revealed conclusive findings that pointed to the necessity of further specific tests. Long-term follow-up studies carried out in 33 individuals failed or were slow to reveal acute or chronic rejection processes in one quarter of the patients, whereas the renal function scintiscans gave the earliest warning of functional disorders, unfavourable developments and complications in another quarter of patients; in the remaining part, the test results were in keeping with the clinical findings. Renal function scintiscans were thus judged to be a valuable diagnostic tool to ascertain and identify disorders occurring soon after surgery as well as to detect the early signs of functional disorders in the transplant during long-term follow-up studies. In view of the fact, however, that the sensitivity of the method in this field of application only is of the order of 75%, further research work appears to be required here. (TRV).

11855 **(INIS-mf—11875) Nephropathy in diabetes. Pathogenetic and clinical features as well as possibilities of immediate diagnosis by radioimmunological detection of albumin in the urine.** Schlagmann, C. (Muenchen Univ. (Germany, F.R.). Fakultaet fuer Medizin). 8 Nov 1984. 132p. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88756368/JAW.

Within the framework of this study, an albumin radioimmunoassay for the immediate diagnosis of diabetic nephropathy in the laboratory was to be introduced and tested for practicability. The assay served as a test tool during a long-term prospective trial designed to yield information relevant to the relationship between optimal metabolic adjustment of the patients using insulin dosimeters and the development of diabetes-induced renal disorders at a later time. The advent of another nephelometric test while this study was still in progress, which was quicker, more convenient to handle and free from radioactivity, prevented the measurements from being carried out on a broader basis. The radioimmunoassay was based on a process by which labeled albumin competes with a predetermined amount of radioactively labeled albumin (I-125) for antibody binding sites. Initial clinical examinations in 14 patients led to the conclusion that there were no close correlations between changes in the daily albumin levels measured in the urine and metabolic fluctuations observed at the corresponding time. Increased microalbuminuria is a highly sensitive, even though non-specific parameter to ascertain any incipient functional impairment of the kidneys. This uncomplicated method of detection is suitable to monitor the renal function of diabetic patients on a routine basis in order to identify those individuals most at risk of developing nephropathy of a clinically relevant degree. (TRV).

11856 **(INIS-mf—11876) Visualisation of osteonecroses on scintiscans, taking particular account of femural head necrosis in patients with kidney transplants.** Kast, H.U. (Tuebingen Univ. (Germany, F.R.). Medizinische Fakultaet). 1984. 58p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88756369/JAW.

It was the aim of this study to describe the different density patterns produced by various forms of aseptic osteonecrosis. Comparative evaluations of X-ray pictures and scintiscans were carried out in order to establish, if skeletal scintiscanning permits a specific diagnosis to be made and to distinguish between the early and late stages of a disease. A further question to be clarified within the framework of this study was the frequency and cause of femural head necrosis in patients having received kidney transplants. For this purpose, combined skeletal and renal function scintiscans were obtained following single injection of 99mTc-MDP. It was found that Perthes disease and femural head necrosis could be diagnosed from the scintiscans 2-3 months before any pathological changes were discernible on the X-ray pictures, as incipient circulatory disorders are already reflected by reduced concentrations of activity;

knee joint necrosis, infarction of bone tissue and osteochondrosis were associated with an increased accumulation of the tracer substance, from the initial through the later stages of these diseases; among 32 patients with kidney transplants, 11 were shown to have developed femural head necrosis and other pathological changes could be predicted from the skeletal scintiscans in a furter 14 cases. It was concluded that skeletal scintiscanning carried out on a routine basis in patients with kidney transplants is a very meaningful procedure for the immediate diagnosis of femural head necrosis and, thus, post-operative surveillance. (TRV).

11857 **(INIS-mf—11877) Comparative evaluation of commercially available HCG radioimmunoassays and the use of HCG as a tracer substance.** Bodemann, C. (Marburg Univ. (Germany, F.R.). Fachbereich Humanmedizin). 22 Feb 1985. 125p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88756370/JAW.

In view of the special oncological aspects involved in the use of HCG and β-HCG as tracer substances in radioimmunological procedures to diagnose and follow-up gynecological carcinomas, it is obvious that commercially available RIA kits must be examined for reliability before they are employed on a broader basis in connection with routine laboratory investigations. Thus, those assays were tested for convenient handling, accuracy, slope of standard curve, sensitivity, specifity and precision of tests tools against commercial control sera, pooled sera rich in HCG as well as so-called normal sera; in some cases, further evaluations were made using LH standard preparations. Due to differences between the WHO standard preparations and the fact that the manufacturers' instructions for use also deviated from one another, follow-up observations in patients showing ovarian carcinomas were likewise taken into account and served as additional reference data. A total of 8 (β-) HCG RIA test kits were examined. From among these, only the 125I-Chorionic Gonadotropin β-Subunit Kit (RSL) and the HCG-β-RIA (Cambridge) were found to lead to satisfactory measurements of (β-) HCG, with the intraassay and interassay variations remaining within acceptable limits, and to show an adequate slope of the standard curves in the low measurement ranges as well as a sufficient degree of sensitivity and specifity. The particular value of methods of detection for (β-) HCG is explained by the complete lack of any other parameters suitable for the surveillance of ovarian carcinomas. The fact that any progress or remission of those tumours may be reflected by changes in the measured HCG values accounts for the great significance of (β-) HCG as a tracer substance, which is only equalled by that of TPA and CEA. In all other genital tumours, HCG determinations cannot be substituted for the more conventional diagnostic procedures. (TRV).

11858 **(INIS-mf—11878) Comparison of radioimmunological and enzyme-immunological methods of determination in thyroid function studies.** Arnold, L.P. (Giessen Univ. (Germany, F.R.). Fachbereich Humanmedizin). 12 Jul 1984. 104p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88756371/JAW.

During the study described here parallel investigations were carried out using radio-immuno-assays (RIA) and enzyme-immuno-assays (EIA) in order to assess the quality and diagnostic value of both these techniques as well as to weigh up their relative advantages and disadvantages in connection with thyroid function studies. The following comparisons were made: T4 RIA versus T4 EIA, T3 RIA versus T3 EIA, T3 uptake versus thyroxine binding capacity, total balance of free hormone bonds. Correlation coefficients of 0.982 for T4 and 0.989 for T3 proved that the test results obtained using either RIA or EIA were in fairly good agreement. Less satisfactory correlation was suggested by a coefficient of 0.807 between the tests for thyroxine binding capacity and T3 uptake, which was even seen to decrease with increasing binding capacity so that the greatest deviations were observed in hyperthyroidism. The same holds true for the free T4 index and total balance, where the correlation coefficient is altered in a similar way by the inclusion of a thyroxine binding capacity EIA. Better agreement was achieved by optimal adjustment of the defined diagnostic ranges for hypothyroidism, euthyroidism and hyperthyroidism. The EIA results were biassed in the presence of hyperbilirubinemia. Intra-assay abd inter-assay veriations were analysed and found to range from 8.1 to 16.9% and 13.6 to 28.1%, respectively. EIA offers advantages over RIA inasmuch as it is free from radioactivity and does not require any special safety measures, although it was judged considerably less favourable than RIA in terms of sensitivity. (TRV).

11859 **(INP—1291/B) Estimation of the radiobiological and kinetic factors of radiosensitivity and radiocurability of metastases of squamous cell carcinoma of the larynx to neck lymph nodes.** Maciejewski, B. (Institute of Nuclear Physics, Krakow (Poland); Instytut Onkologii, Krakow (Poland)). 1985. 143p. (In Polish). NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS. Order Number DE88705290/JAW.

The usefulness of theoretical model of tumour growth and experimental methods of kinetic and radiobiological factors for analysis of clinical data to improve the effectiveness of dose fractionation are checked. 176 refs., 27 figs., 19 tabs.

11860 **(INP—1298/B) Use of lineary-quadrate model of equivalent doses in neoplasms' radiotherapy.** Maciejewski, B.; Reinfuss, M.; Lesiak, J.; Huczkowski, J. (Centrum Onkologii im. M. Sklodowskiej-Curie, Krakow (Poland); Institute of Nuclear Physics, Krakow (Poland)). (Institute of Nuclear Physics, Krakow (Poland)). 1985. 48p. (In Polish). NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705295/JAW.

The theoretical bases of lineary-quadrate model of equivalent doses as well as the principles of its use are presented. The tables and the formulae simplifying the mathematical calculations of equivalent doses are enclosed. Two computer programs DAFR and DARE are also given. 28 refs., 5 figs., 19 tabs. (A.S.).

11861 **(IPEN-Pub—135) Preparation of iodine-125 - labeled insulin for radioimmunoassay: comparison of chloramine T and iodogen iodination.** Toledo e Souza, I.T. de; Giannella Neto, D.; Wajchenberg, B.L. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo, SP (Brazil)). May 1988. 8p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704154/JAW.

Stoichiometric iodination of porcine insulin was performed to the general method of Hunter and Greenwood with modifications recommended by Roth. These method was compared with radioidination using Iodogen. Films of Iodogen react rapidly in the solid phase with aqueous mixtures of I /sup -/and proteins. For two methods satisfactory activity of the labeled porcine insulin was obtained and characteristics of the radioimmunoassay were studied.

11862 **(ISN—88-15) Development of a data acquisition system in form of an apparatus which is specially designed for the study of the cerebral metabolism employing radioactive tracers.** Ponchon, J. (Grenoble-1 Univ., 38 (France). Inst. des Sciences Nucleaires). Mar 1988. 128p. (In French). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88756258/JAW.

The subject of this thesis is the development of a data acquisition system in form of an apparatus which is specially designed for the study of cerebral metabolism employing radioactive tracers. Currently, the test is based on the continuous inhalation of gas identified with oxygen 15. After an inhalation period of 6 to 8 minutes the local brain radioactivity attains an equilibrium which corresponds to the parameters of brain metabolism. The constant measurement of the radioactivity facilitates the monitoring of the evolution of these parameters. The apparatus consists of an assemby of lead collimators in which are lodged 26 gamma ray detectors (INa probes), each one of which scans a particular brain region. For ease of use and the provision of numerous possibilities, each detector has been assigned a multichannel pulse height analyser which has been developed by ourselves in order to correspond to and to comply with the demands of our tests. They are equipped with a device which automatically corrects for dead time thereby permitting the analysis of random impulses of a rate greater than 50.000 per second with a loss of less than 1%. The multichannel analysers are connected to a central computer which by means of suitably adapted software allows the calibration of different channel of measurement, controls, the choice of the zone of interest to be integrated and the presentation of integrated results in form of graphs.

11863 (PB—88-160783, pp 60-107) **Medical implications of extensive physical and sequence characterization of the human genome.** Friedmann, T. Feb 1988. NTIS, PC A13. Order Number TI88013479/JAW.

In Mapping our genes: Federal genome projects: How vast? How fast?: Volume 1, Contractor reports.

During the past several years, methods have become available that promise to allow the entire human genome to be completely defined at the nucleotide level. It is a contentious issue, one that involves questions of scientific and medical priorities and goals, allocation of funding and other scientific resources and the relative roles of government and the academic and business communities in the pursuit of science and the delivery of health care. The direct and implied goals of much of modern biomedical research are to develop an understanding of the causes and mechanisms of pathogenesis of human disease, to devise effective diagnostic and screening procedures for early intervention, to develop effective methods of prevention, to develop truly effective methods of therapy and to bring all of these within reach of all who need care. It is widely assumed that a complete characterization of the human genome---the so-called "human genome initiative"---will lead to major improvements in the understanding and management of many forms of human disease. The purpose of this report is to examine that assumption, to review the present approaches to the characterization and management of human genetic diseases and to examine the potential impact that a large-scale physical and genetic characterization of the human genome may have on the delivery and the effectiveness of future medical care. To do so and to understand some of the medical pressures that affect attitudes toward a large-scale human genome characterization, it is helpful to know the state of effectiveness of current approaches to genetic disease management. 38 refs.

11864 **Detection of cardiomyopathy in an animal model using quantitative autoradiography.** Kubota, K.; Som, P.; Oster, Z.H.; Brill, A.B.; Goodman, M.M.; Knapp, F.F. Jr.; Atkins, H.L.; Sole, M.J. (Brookhaven National Lab., Upton, NY (USA)). *Journal of Nuclear Medicine;* **29**: No. 10, 1697-1703(Oct 1988).

A fatty acid analog (15-p-iodophenyl)-3,3 dimethyl-pentadecanoic acid (DMIPP) was studied in cardiomyopathic (CM) and normal age-matched Syrian hamsters. Dual tracer quantitative whole-body autoradiography (QARG) with DMIPP and 2-[^{14}C(U)]-2-deoxy-2-fluoro-D-glucose (FDG) or with FDG and ^{201}Tl enabled comparison of the uptake of a fatty acid and a glucose analog with the blood flow. These comparisons were carried out at the onset and mid-stage of the disease before congestive failure developed. Groups of CM and normal animals were treated with verapamil from the age of 26 days, before the onset of the disease for 41 days. In CM hearts, areas of decreased DMIPP uptake were seen. These areas were much larger than the decrease in uptake of FDG or ^{201}Tl. In early CM only minimal changes in FDG or ^{201}Tl uptake were observed as compared to controls. Treatment of CM-prone animals with verapamil prevented any changes in DMIPP, FDG, or ^{201}Tl uptake. DMIPP seems to be a more sensitive indicator of early cardiomyopathic changes as compared to ^{201}Tl or FDG. The trial of DMIPP and SPECT in the diagnosis of human disease, as well as for monitoring the effects of drugs which may prevent it seems to be warranted.

5507 Microbiology

REFER ALSO TO CITATION(S) 10643, 10656, 11809, 11810

5509 Pathology

REFER ALSO TO CITATION(S) 11830, 11880, 11927, 11929, 11930, 11933, 11934, 11935, 11936, 11937

11865 **(AD-A—198603/3/XAB) Development of a toxin knowledge system. Annual summary report, 6 April 1987-5 April 1988.** Trammel, H.L. (Illinois Univ., Urbana (USA). Dept. of Veterinary Biosciences). 15 May 1988. 54p. (DAMD—17-87-7114). NTIS, PC A04/MF A01.

The Toxin Knowledge System (TKS) is being developed to provide rapidly accessible, up-to-date knowledge about low molecular weight toxins. This system will integrate facts from published literature into monographs on individual toxins. Development utilizes a relational data-base management system and associated fourth-generation programming language on minicomputer. It uses a standard knowledge structure, structured abstracting processes, standard nomenclature systems, and computer-generated structured monographs. This system exploits the structured style of scientific writing to collect information on low-molecular-weight toxins and store this information in structured form. The application guides the abstractor in this collection process, facilitating the extraction of similar information from different papers. A sophisticated user interface allows the user to readily add, find, delete, and update data in the system. Currently, TKS manages citation data for both journals and books, has keyword access to entered citations, and can collect information on a paper including the study designs, the subjects and exposure regimens used, and the links to connect this data to the clinical findings reported.

5510 Physiological Systems

REFER ALSO TO CITATION(S) 11827, 11828

11866 **(INIS-mf—11870) Comparative studies on the myocardial potassium and thallium exchange in isolated papillary muscles of guinea pigs.** Krettek, C. (Muenchen Univ. (Germany, F.R.). Fakultaet fuer Medizin). 3 Aug 1982. 298p. (In German). NTIS (US Sales Only), PC A13/MF A01. Order Number DE88756363/JAW.

For the distribution of Tl 201 an analogous potassium membrane transport is assumed with the use of myocardial scintiscanning. This hypothesis was tested on the membrane model of the papillary muscle. The absorption and discharge behaviour of Tl 201 and K 42 was studied in isolated, stimulated papillary muscles from the right ventricle of a guinea pig heart in Ringer's solution at 36/ sup 0/C to answer the question of whether there are differences in ion transport. The results indicate only a partially similar membrane behaviour of K and Tl. Differences and similarities in the membrane transport of K and Tl allow themselves to be easily interpreted, when energetic, electric, and geometric factors as well as the various affinities of K and Tl for intracellular proteins are considered.

11867 **Desensitization, histamine release and the aggregation of IgE on human basophils.** Goldstein, B. (Univ. of California, Los Alamos, NM (USA)). pp 3-40 of Theoretical immunology, Part 1: Part 1, Proceedings. Perelson, A.S. (ed.). Redwood City, CA; Addison-Wesley Publishing Co., Inc. (1988).

From Theoretical immunology workshop; Santa Fe, NM, USA (1 Jun 1987).

The existence of basophils and mast cells, with specific IgE bound to their Fc/sub epsilon/ receptors, has allowed both experimental and theoretical biologists to test their ideas about the role of antibody aggregation in cell activation and desensitization. Because, for these cells, activation and desensitization are rapid (minutes) and require no accessory cells or growth factors, this is one of the simplest systems for studying such processes. For the theorist, there is more detailed data on these cells than on any other cells in the immune system. The models that have been developed so far are still quite naive. The dramatic progress made by experimentalist in unraveling this system serves as a challenge to theorists to develop realistic models that can explain what has been observed and make new testable predictions.

11868 **Molecular basis for immune regulation: the immunon hypothesis.** Dintzis, H.M.; Dintzis, R.Z. (Johns Hopkins Univ., Baltimore, MD (USA)). pp 83-88 of Theoretical immunology, Part 1: Part 1, Proceedings. Perelson, A.S. (ed.). Redwood City, CA; Addison-Wesley Publishing Co., Inc. (1988).

From Theoretical immunology workshop; Santa Fe, NM, USA (1 Jun 1987).

Factors other than the antigenic material itself have been implicated in immune regulation. Antibody molecules produced during an immune response can interact with the initiating immuno-

gen and affect its subsequent stimulatory behavior. During the past two decades a plethora of additional complex facts have been discovered which make difficult an unambiguous assignment of cause and effect within the multiple interacting phenomena of immune regulation. Numerous types of differentiated cells exist within the lymphoid tissues and these cells produce many products, both on their surfaces and secreted in soluble form. In addition, these cells have different receptors for, and respond to a variety of, molecules in their surroundings. Lastly, antibody molecules can be generated against chemical different antibody molecules within the same animal, raising the possibility of yet another kind of regulatory interaction at this level. The authors experimental results and their interpretation, which they shall discuss in this report, have led them to the conclusion that antigenic material itself in its various physical forms may play a central role, perhaps the central role, in the ongoing regulation of the immune response.

11869 **Cell-cell adhesion resembles receptor crosslinking.** Bell, G.I. (Los Alamos National Lab., NM (USA)). pp 105-114 of Theoretical immunology, Part 1: Part 1, Proceedings. Perelson, A.S. (ed.). Redwood City, CA; Addison-Wesley Publishing Co., Inc. (1988).

From Theoretical immunology workshop; Santa Fe, NM, USA (1 Jun 1987).

Experiments were performed which determined that whenever cell adhesion is mediated by receptors that are otherwise able to move in the plane of the cell membrane, a marked accumulation of receptors in a limited contact area is to be expected. The accumulation results from the high local concentration of membrane-associated reactants in the contact area, while nonspecific repulsive forces between cell glycocalyces cause the contract area to be small, or zero below the adhesion threshold. Since the densities of receptors in a contact area can be quite comparable to those locally achieved in crosslinked receptor-ligand complexes, the authors expect that cell-cell adhesion can produce all of the effects on cell behavior that are associated with receptor crosslinking. In some cases, the receptors or associated molecules, such as the T3 complex, may serve as selective ion channels. They have also seen that the cells must actively terminate adhesion. Acidification of the extracellular microenvironment of the contact area is one possibility, as is enzymatic cleavage of receptors. Perhaps there is some endocytosis of material in the contact area. Whatever the process, it is likely for cells of the immune system that the mechanisms terminating adhesion are initiated by the adhesion itself.

11870 **B cell clonogenesis induced by anti-immunoglobulin (anti-Ig) and interleukins.** Wetzel, G.D. (Basel Institute for Immunology, Basel (Switzerland)). pp 116-124 of Theoretical immunology, Part 1: Part 1, Proceedings. Perelson, A.S. (ed.). Redwood City, CA; Addison-Wesley Publishing Co., Inc. (1988).

From Theoretical immunology workshop; Santa Fe, NM, USA (1 Jun 1987).

To investigate the role of growth factors in B cell activation, the author chose anti-Ig to model antigen effects and serve as a polyclonal B cell activator. Although polyclonal, anti-Ig is thought to mimic antigen by interacting with B cell surface antigen receptors and inducing crosslinkage and, and hence, early activation steps. In summary, there appears to be at least two distinct populations of B lymphocytes with distinct triggering requirements. One major population requires receptor crosslinking and IL4 to transit from G_0 and G1b (and hence, proliferate). The other apparently does not respond to receptor crosslinking mediated by anti-Ig, but requires a different primary signal and IL5 to transit from G_0 to G1b.

11871 **Where did the macrophage get the antigen from?.** Ninio, J. (Institut Jacques Monod, Paris (France)). pp 127-130 of Theoretical immunology, Part 1: Part 1, Proceedings. Perelson, A.S. (ed.). Redwood City, CA; Addison-Wesley Publishing Co., Inc. (1988).

From Theoretical immunology workshop; Santa Fe, NM, USA (1 Jun 1987).

It is commonly admitted that an antigen, or a processed antigen, is first presented to a T cell by a macrophage or some other antigen-presenting cell, bearing an MHC molecule compatible with the T-cell receptor. The T cell thus activated, when encountering a B cell, tests for the presence of the same antigen, through a similar mechanism of MHC-dependent antigen presentation. If the test is positive, the B cell is rewarded with a variety of growth factors.

11872 **Statistics in immunology and biochemistry: an application to T cell antigenic sites.** Spouge, J.L.; Berzofsky, J.A. (National Institutes of Health, Bethesda, MD (USA)). pp 131-146 of Theoretical immunology, Part 1: Part 1, Proceedings. Perelson, A.S. (ed.). Redwood City, CA; Addison-Wesley Publishing Co., Inc. (1988).

From Theoretical immunology workshop; Santa Fe, NM, USA (1 Jun 1987).

This paper discusses the application of statistics to biochemistry and, in particular, the application of statistical matching techniques to the problem of T cell antigenic peptides. Statistics are indispensable in the practice of clinical medicine; they have not found similar use in biochemistry, probably because biochemically interesting null hypotheses have not been available for statistical testing.

11873 **Regulation of lymphocyte proliferation by proliferating lymphocytes: is lactate a central regulatory element in the immune system?.** Droege, W. (German Cancer Research Center, Heidelberg (Germany, F.R.)). pp 161-166 of Theoretical immunology, Part 1: Part 1, Proceedings. Perelson, A.S. (ed.). Redwood City, CA; Addison-Wesley Publishing Co., Inc. (1988).

From Theoretical immunology workshop; Santa Fe, NM, USA (1 Jun 1987).

Environmental pathogens constantly trigger proliferative processes in the lymphoid system as part of the normal immune response, but the total number of lymphocytes in the periphery remains, nevertheless, essentially constant. The number of newly formed lymphocytes is obviously balanced by the decay rate. This important link between renewal rate and decay rate suggests the possibility that the proliferating lymphocyte itself may provide the signal for the decay. In this report, the author will summarize experiments suggesting that lactate may be the physiological mediator which provides the hypothetical signal for the decay and which also downregulates the lympho-proliferative activity. Most interestingly, lactate inhibits DNA synthesis, but augments the net production of the T-cell growth factor interleukin 2 in activated T-cell populations.

11874 **Modeling dynamical aspects of the immune response: I. T cell proliferation and the effect of IL-2.** Kevrekidis, I.G.; Zecha, A.D.; Perelson, A.S. (Princeton Univ., NJ (USA)). pp 167-198 of Theoretical immunology, Part 1: Part 1, Proceedings. Perelson, A.S. (ed.). Redwood City, CA; Addison-Wesley Publishing Co., Inc. (1988).

From Theoretical immunology workshop; Santa Fe, NM, USA (1 Jun 1987).

The authors apply methods of numerical bifurcation theory in the construction and evaluation of mathematical models of the immune response. They focus on the dynamics of the interaction of T cells with IL-1, IL-2 and antigen at several levels of modeling complexity. They examine the dependence of the qualitative dynamics on key parameters, and attempt to draw analogies between numerically predicted and experimentally observed behavior. The predicted behavior is interesting from a mathematical point of view (they describe a double zero singularity) even for these simple models. The most significant qualitative effect observed is the critical dependence of the final system state on small variations of IL-2 during the response. This makes them believe that coupling of the immune responses to antigenically unrelated epitopes through IL-2 and other lymphokines may be a critical factor in determining the ultimate effectiveness of the immune response to pathogenic organisms.

11875 **Role of multistability in an immune response model: a combined discrete and continuous approach.** Kaufman, M. (Universite Libre de Bruxelles, Brussels (Belgium)). pp 199-222 of Theoretical immunology, Part 1: Part 1, Proceedings. Perelson, A.S. (ed.). Redwood City, CA; Addison-Wesley Publishing Co., Inc. (1988).

From Theoretical immunology workshop; Santa Fe, NM, USA (1 Jun 1987).

In this article, the authors present an attempt at developing a theoretical framework for the study of complex regulatory systems, and at integrating the various processes known to regulate antibody production into a coherent ensemble that accounts for some main features of the humoral immune response. A novel aspect of their approach is the combined use of two methods of description: a logical or discrete formalization, and a more classical analysis in terms of differential equations. Their purpose has been to investigate to what extent one may account for some important aspects of immune regulation by simple models. Starting with a small number of essential components (antigen, B, T helper, T suppressor cells of the relevant specificity, and the corresponding antibodies) and a few experimentally documented interactions between them, they have developed a class of models which predict a high multiplicity of regime state, both in the absence of antigen and for constant antigen levels.

11876 **Systematic approach to modeling immune response.** Eisenfeld, J.; Prueitt, P. (Univ. of Texas, Arlington (USA)). pp 223-255 of Theoretical immunology, Part 1: Part 1, Proceedings. Perelson, A.S. (ed.). Redwood City, CA; Addison-Wesley Publishing Co., Inc. (1988).

From Theoretical immunology workshop; Santa Fe, NM, USA (1 Jun 1987).

Consideration of the interactions among cells and cell products involved in regulating antibody responses suggests that such interactions are organized into integrated circuits. To illustrate how a circuit-based regulatory system could be expected to operate, various laboratories have introduced a multitude of models; however, when these models are tested against observations regarding memory and low- and high-dose paralysis, none are completely satisfactory. This paper applies to the boolean approach to obtain a step-by-step mathematical procedure for developing an immune response model. The procedure begins by listing a complete set of constraints that the model is required to satisfy and culminates in the development of a system of differential equations that is guaranteed to satisfy those constraints. This procedure is used to obtain a minimal two-lymphocyte model that simulates a set of nine immune response patterns Then, it is illustrated how this minimal model serves as a core regulatory circuit which can be developed into more detailed models by adding or expanding circuits.

11877 **Flow topology of the Herzenberg immunological control networks.** King, R.B. (Univ. of Georgia, Athens (USA)). pp 257-272 of Theoretical immunology, Part 1: Part 1, Proceedings. Perelson, A.S. (ed.). Redwood City, CA; Addison-Wesley Publishing Co., Inc. (1988).

From Theoretical immunology workshop; Santa Fe, NM, USA (1 Jun 1987).

Immunological control networks can be modeled by bipartite, signed, directed graphs called influence diagrams. Possible flow topologies around unstable steady states in such systems can be determined by kinetic logic based on the directed Boolean cubes of switching circuit theory. An example of an immunological control network is the Herzenberg core regulatory circuit (CRC) which consists of a single positive circuit of length 4 with alternating positive and negative edges. The flow topology of this CRC indicates locking into one of two stable configurations corresponding to help and suppression. Addition of a single vertex to the Herzenberg CRC so as to preserve the bipartite nature of the signed, directed graph leads to a network with five independent internal variables and two connected feedback circuits, either positive and negative circuits of length 4 or positive circuits of lengths 4 and 2. The flow topology of either of these systems indicates that addition of the fifth vertex switches the basis four-vertex CRC into one of its two stable configurations.

11878 **Logical dynamic systems approach to the regulation of antigen-driven lymphocyte stimulation.** Sieburg, H.B. (Salk Institute for Biological Studies, La Jolla, CA (USA)). pp 273-294 of Theoretical immunology, Part 1: Part 1, Proceedings. Perelson, A.S. (ed.). Redwood City, CA; Addison-Wesley Publishing Co., Inc. (1988).

From Theoretical immunology workshop; Santa Fe, NM, USA (1 Jun 1987).

The authors introduce a novel object-oriented approach to an antigen-driven mathematical model of the immune system, called a Cellular Device Machine. This approach, which combines kinetic logic and automaton theory with principles from artificial intelligence, in particular knowledge engineering, offers several advantages. First, it remains simple. Second, by defining the immune system in terms of objects and communication between them, the problem of complexity melt-down does not occur. Third, due to their choice of mathematical techniques, the Cellular Device Machine (CDM) can be directly implemented on a personal computer and be easily extended and modified to allow simulation of both the normal and diseased immune system. Fourth, multiple time scales can be introduced at the object level. Consequently, CDM behavior can closely match the intrinsic parallelism of immune system behavior.

11879 **Decision criteria and coherence in the regulation of the immune response.** Bretscher, P.A. (Univ. of Saskatchewan, Saskatoon (Canada)). pp 295-309 of Theoretical immunology, Part 1: Part 1, Proceedings. Perelson, A.S. (ed.). Redwood City, CA; Addison-Wesley Publishing Co., Inc. (1988).

From Theoretical immunology workshop; Santa Fe, NM, USA (1 Jun 1987).

Recent studies have revealed that the immune response is very coherently regulated. This coherence implies that there are universal decision criteria applying to the response to all the epitopes of an antigen molecule. Coherence must impose restraints on possible models of cellular regulation. The author describes some examples of this coherence, and their implication for cellular regulation, as well as some ideas on the decision criteria embedded in the cellular circuits of the immune system. He also outlines attempts to experimentally test the validity of these proposed decision criteria. This will give rise to a partial description of cellular interactions that is in conflict with decision criteria proposed by others. He therefore feels it appropriate to discuss why he feels these latter decision criteria are difficult to reconcile with some general features of immune regulation.

11880 **Antibody affinity distribution-based models for vaccine potency assessment.** Hingley, P.J. (Kingston Polytechnic, Surrey (England)). pp 311-326 of Theoretical immunology, Part 1: Part 1, Proceedings. Perelson, A.S. (ed.). Redwood City, CA; Addison-Wesley Publishing Co., Inc. (1988).

From Theoretical immunology workshop; Santa Fe, NM, USA (1 Jun 1987).

Extensions of conventional methods for measurement of the potency of foot and mouth disease vaccine batches are considered. A timecourse model is described; based on a single differential equation for antibody of affinity K, with such equations collected together over all clones. The model exhibits useful properties, the persistence of mean antibody affinity over total antibody concentration giving a simple mathematical expression for immune memory. The model is related to information obtainable from immunoassays, specifically the neutralization test and the ELISA test. A logistic model is shown to be applicable to ELISA data, and areas for further experimentation are identified.

11881 **Immune process stochastic structure.** Mohler, R.R.; Farooqi, Z.H. (Oregon State Univ., Corvallis (USA)). pp 327-346 of Theoretical immunology, Part 1: Part 1, Proceedings. Perelson, A.S. (ed.). Redwood City, CA; Addison-Wesley Publishing Co., Inc. (1988).

From Theoretical immunology workshop; Santa Fe, NM, USA (1 Jun 1987).

A simple building-block synthesis of the immune system is presented here. It is shown that, mathematically, this complex system consists of numerous cascades bilinear processes which are themselves coupled together by nonlinear gain elements. These coupling elements include stimulation and inhibition terms which are a focus of much immunological research. The mathematical structure is further divided for convenience into cellular and molecular components with mainly molecular terms affecting nonlinear coupling. Then, the derived finite-state estimator shows significance of antigen information which is the single key nonlinear feedback in humoral process. Compartmental models are presented, and, after modeling experimental data for lymphocyte circulation in rats, a

discrete, stochastic bilinear, time-series approximation is statistically analyzed. This lymphocyte model should be considered as one approximation and not the final answer. It also shows the need for more complete data.

11882 **Maturation of the immune response via adaptive walks on affinity landscapes.** Kauffman, S.A.; Weinberger, E.D.; Perelson, A.S. (Univ. of Pennsylvania, Philadelphia (USA)). pp 349-382 of Theoretical immunology, Part 1: Part 1, Proceedings. Perelson, A.S. (ed.). Redwood City, CA; Addison-Wesley Publishing Co., Inc. (1988).

From Theoretical immunology workshop; Santa Fe, NM, USA (1 Jun 1987).

The aim in this article is to apply Darwin's idea of natural selection to the maturation of the immune response. In doing so, the authors shall introduce recent results concerning the character of adaptive walks via fitter mutants to local optima, where such walks occur in rugged fitness landscapes with many peaks, ridges, and valleys. In the present context, the fitness landscape in question is determined by the affinity with which each possible antibody molecule in an organism's repertoire binds to a given immunizing epitope. By an adaptive walk, they mean a random walk on the affinity landscape where a step can only be taken if it leads to a higher affinity. Maturation of the immune response refers to the observation that after immunization the average affinity of serum antibody for the immunizing epitope increases.

11883 **Affinity maturation and ecological succession: an analogy suggested by computer modeling.** Weinand, R.G.; Conrad, M. (Wayne State Univ., Detroit, MI (USA)). pp 383-400 of Theoretical immunology, Part 1: Part 1, Proceedings. Perelson, A.S. (ed.). Redwood City, CA; Addison-Wesley Publishing Co., Inc. (1988).

From Theoretical immunology workshop; Santa Fe, NM, USA (1 Jun 1987).

Affinity maturation, the progressive increase of antibody affinity for antigen, is not a logical consequence of the clonal-selection model, and is, in fact, inconsistent with clonal selection unless additional mechanisms are assumed. The authors show, through computer modeling, that all the essential phenomena of affinity maturation, including its dose dependency, can be duplicated in detail in the framework of clonal selection by assuming two classes of lymphocytes, generalists and specialists. The generalists are analogous to the pioneer species that dominate in the early stages of ecological succession, while the specialists are analogous to the highly adapted, conservative species that dominate in the later stages of evolution.

5520 Public Health

REFER ALSO TO CITATION(S) 11736, 11740, 11741, 11742, 11743, 11744, 11745, 11747, 11748, 11749, 11751, 11752, 11753, 11755, 11758, 11760, 11761, 11762, 11809, 11810, 11945, 11946

11884 **(PB—89-120703/XAB) National Institute for Occupational Safety and Health projects for Fiscal ear 1988.** (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA)). May 1988. 245p. (DHHS/PUB/NIOSH—88-113). NTIS, PC A11/MF A01.

See also report for 1987, PB—88-103759.

Project plans for fiscal year 1988 under the direction of the National Institute for Occupational Safety and Health (NIOSH) were presented along with the planning format used, organizational chart, and mission statements from the various divisions of NIOSH. Summaries of the planning strategies and specific projects are presented for each of the following areas of research: occupational lung diseases, musculoskeletal-system disorders, occupational cancers, severe occupational traumatic injuries, occupational cardiovascular diseases, disorders of reproduction, neurotoxic disorders, noise induced hearing loss, dermatological conditions, and psychological disorders. Projects were also listed as they related to each of the following divisions: biomedical and behavioral science, physical sciences and engineering, respiratory disease studies, safety research, standards development and technology transfer, training and manpower development, and surveillance, hazard evaluations, and field studies.

5530 Agriculture And Food Technology

REFER ALSO TO CITATION(S) 10891, 11731, 11789

11885 **(CNIC—00066) Studies on varietal radiosensitivity and genetic effect in triticum aestivum L.** Feng Zhijie; Wang Linqing. (Chinese Academy of Agricultural Sciences, Beijing (China). Inst. for Application of Atomic Energy). (China Nuclear Information Centre, Beijing, BJ). Sep 1987. 19p. (In Chinese). (AC-IAAE—0003). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704090/JAW.

Dormant seeds (with 13% water content) of 49 wheat varieties (T riticum aestivum L.) were irradiated with /sup 60/Co-γ ray of various doses, and the varietal radiosensitivities and the genetical effects were studied in experimental plots and laboratories. Significant differences in radiosensitivity were found among the varieties used in present experiment. The varietal radiosensitivity of T riticum aestivum L. manifested a continuous variation, which accords approximately with the normal distribution, from the sensitive to the resistant to /sup 60/Co-γ rays. 49 varieties utilized could be divided into five groups with different radiosensitivity to /sup 60/Co-γ rays: higher resistent, resistant, intermediat respose, sensitive and higher sensitive. It was found that most of the mutant varieties improved by irradiation were more resistant to γ rays than the local varieties which were more resistant than recombination varieties bred by crossbreeding, that is radiation-induced mutant varieties < local varieties < crossed recombination varieties in radiosensitivity. It suggested that the self-repairability of DNA damage was the main factor governing the varietal radiosensitivity. Genetical effects of 9 varieties with different sensitivity were compared in M/sub 2/ generation. The results showed that mutation frequencies, mutation spectra and variebilities of the quantative traits varied with varieties. Higher mutation frequencies, wider mutation spectra and greater variabilities were observed in the sensitive varieties than in the resistant ones, and it suggested that there is a greater potential for selecting mutants in M/sub 2/ generation of more sensitive varieties.

11886 **(CNIC—00094) Study on the improvement of breeding effects by γ-ray irradiation of wheat hybrids with middle-lowered dosage.** Wu Zhenlu. (Xinjiang Academy of Agricultural Sciences, Inst. for Atomic Energy Application (China)). (China Nuclear Information Centre, Beijing, BJ). 1987. 10p. (In Chinese). (A-29-IAAE—0007). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704094/JAW.

Half of the grains was irradiated from spring wheat hybrids of 118 cross combinations with 8 kR '6'0Co γ-ray, and the another half of the grains was taken as CK. Having chosen the 118 hybrid combinations for many years, 'Xin Chun 2' which is lodging resistant, drought resistant and yields over 7.5 t/ha has been bred from the irradiated combination of 'Sieta Cerros x Qi Chun 4'. By the study of 10 characters of 11 cross combinations, the result shows that variation coefficients of the all characters of F/sub 2/M/sub 2/ are greater than those of F/sub 2/. And most of the variation coefficients of characters of F/sub 2/M/sub 2/ of 'Sieta Cerros x Qi Chun 4' are greater than those of ordinary combinations. Having studi·d simple correlation coefficients of 10 characters, the result shows that frequency of correlation coefficients changed significantly is up to 35 {similar←to} 40% in F/sub 2/M/sub 2/ of combinations of 'Sieta Cerros x Qi Chun 4' or /sup Q/i Chun 4 x Sieta Cerros/sup ,/ which is 1 {similar←to} 5 times as great as F/sub 2/M/sub 2/ of ordinary combinations. In addition, the radiosensitivity of different material cytoplasm was found to be variant. The correlation of the lenghth of main ear, numbers of seed-setting spikelets of main ear, the spikelet numbers of main ear and grain numbers of main ear is controlled by cell nucleus. But the 100-grain-weight per plant and plumpness of grains have close relations with the cytoplasm.

11887 **(CNIC—00096) Studies on possibility of building radiation centre in Hunan Province.** Tang Chuandao. (Hunan Inst. of Atomic Energy Application In Agriculture (China)). (China Nuclear Information Centre, Beijing, BJ). 1987. 7p. (In Chinese). (IAAE—0008). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704096/JAW.

Hunan province is rich in agriculture products and their by-products. The processing and preservation of those products after porduction is an urgent problem to solve. However, radiation techniques can solve the problem of the processing and preservation of part of those products which can not be solved by normal ways. Only in Changsha area, the products such as leather and their products, dried and fresh fruit, medical equipments, industrial chemicals and so on, which can be provided to irradiate, weigh over 1 x 10/sup 5/ tons a year. In order to advance the research and application of radiation techniques in the province, over 40 units have been investigated in the province and other provinces. Since 1983, six informal discussions or demonstration meetings were held. 15 pieces of various reports and materials have been put forward. The necessity, possibility, size, place, development aim and united research of building a radiation centre have been scientificly demonstrated and a certain basis have been provided for building radiation centre.

11888 **(ENEA-RT-PAS—88-14) Influence of domestic and industrial treatment of food on Cs 137 content.** Lombardi, C.C.; Monte, L. (ENEA, Casaccia (Italy). Centro Ricerche Energia). (ENEA, Rome (Italy)). 1988. 15p. (In Italian). NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705246/JAW.

The environmental contamination due to the Chernobyl accident offers a large amount of data concerning the radioactive contamination of human food-chain. Using those data a research is being carried out to evaluate the behaviour of some radionuclides in food subjected to technological or domestic treatment. In this paper the authors discuss the consequences on the content of Cs-137 a) of domestic cooking of alimentary "pasta", b) of wheat milling, c) of milk coagulation to produce cheese.

11889 (INIS-mf—11332, pp 30) **Possibility of gamma ray sterilization by using ITU Triga Mark 2 reactor.** Tugrul, B.; Bilge, A.N.; Yavuz, H. (Istanbul Technical Univ. (Turkey). Inst. for Nuclear Energy). 1988. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705189/JAW. (CONF-8809213—).

From IAEA Meeting: 10th European TRIGA users' conference; Vienna, Austria (14 Sep 1988).

11890 **(RISO-M—2685) Agricultural research department annual report 1987.** (Risoe National Lab., Roskilde (Denmark)). Jan 1988. 50p. (In Danish). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755752/JAW.

The annual report gives a general review of the research work of the department. The activities of the year are described in 4 short project reports each followed by a list of publications, posters and lectures. Further, the report gives 3 review articles on selected subjects related to the work: "The impact of flue gas desulphurization products on the environment", "Banding of chromosomes" and "Molecular studies of the powdery mildew fungus". Included in the report is also a list of the staff members, guest scientists and students, lectures given at the department, and a list of travel- and other activities.

11891 **(STEV-TB—88-10) Numerical model for calculation of vertical transport of momentum in areas with large roughness elements.** Haeggkvist, K. (Swedish Meteorological and Hydrological Inst., Norrkoeping. Meteorology and Climatology). (Statens Energiverk, Stockholm (Sweden)). 1988. 31p. (In Swedish). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755885/JAW.

A numerical flow model, to describe the flow field in and around large roughness elements or vegetation, has been constructed. It concerns neutral atmospheric stability conditions and has been applied to a 'numerical' short rotation cultivation area for two different wind speeds. The results of the calculations concerning the short rotation cultivation area has not been compared with field measurements. Development of the boundary layer, caused by the vegetation, show good agreement with literature data. A slight uncertainty prevails concerning the best way to represent the geometry of the vegetation elements. The vertical projection area of the vegetation elements is very difficult to measure, and also wind dependent. This has led to the use of the total area of the dominant vegetation element, Leaf Area Index, which is relatively easy to determine. (U.W.).

56 BIOMEDICAL SCIENCES, APPLIED STUDIES

5601 Radiation Effects

REFER ALSO TO CITATION(S) 12332

11892 **(AD-A—199250/2/XAB) Prostaglandins and radiation enteritis. Technical report, 1 May 1985-30 April 1987.** Delaney, J.P. (Minnesota Univ., Minneapolis (USA). Dept. of Surgery). 30 Dec 1987. 86p. NTIS, PC A05/MF A01.

A series of experiments was done to test the proposition that radiation to the intestine induces prostaglandin production which, turn, enhances the radiation injury. The results did not support the hypothesis, in that, pharmacologic blockade of prostaglandins or pretreatment with systemic prostaglandins did not significantly alter mortality following abdominal radiation. Neither did prostaglandin manipulations alter hemopoietic suppression. Enteropolling was not induced by abdominal radiation. Systemic pretreatment with free-radical inhibitors did not alter mortality following abdominal radiation. Intestinal mucosal integrity was found to be partially preserved by a variety of agents placed in the lumen prior to radiation of isolated intestinal segments. These included prostaglandin E2, cyclooxygenase inhibitors, and adrenal cortical steroids.

11893 **(BMU—1988-180) Radiological impact of normal operation of nuclear fuel cycle installations and of conventional power plant.** Bonka, H.; Kueppers, J.; Horn, H.G. (Bundesministerium fuer Umwelt, Naturschutz und Reaktorsicherheit, Bonn (Germany, F.R.); Technische Hochschule Aachen (Germany, F.R.). Lehr- und Forschungsgebiet Strahlenschutz in der Kerntechnik). Jan 1987. 251p. (In German). GRM Werbeberatung - Werbemittlung - PR, Eggenstein-Leopoldshafen, (Germany, F.R.).

Schriftenreihe Reaktorsicherheit und Strahlenschutz. Ergebnisberichte, Untersuchungen, Studien, Gutachten.

Due to varying methods and data used for studies on the radiological impact, the results have been deviating considerably, so that the study in hand focuses in particular on the determination of radiation exposure due to ingestion. For evaluation of doses calculated by means of the ingestion dose factors according to ICRP 30, dose factors are calculated with the nuclide-specific activity model for all radionuclides of which stable isotopes are incorporated by ingestion. The calculated effective doses due to specified normal operation of the installations under review are below 30 μSv per annum. 95% of the collective doses are the result of effective doses lower than 3 μSv per annum. Specified normal operation of nuclear fuel cycle installations (nuclear power plant, reprocessing plant, fuel element fabrication, conversion plant, enrichment plant, uranium mines, ore processing plant), or of conventional power plant (coal and brown coal fueled stations, oil and natural gas fueled power stations) has a minimal radiological impact on the population, as compared to the natural radiation exposure, even if one takes into account a risk factor on the safe side. (orig./HP) With 195 figs., 26 tabs., 142 refs.

11894 **(BNL—42099) Summary update of the Brookhaven tritium toxicity program with emphasis on recent cytogenetic and lifetime-shortening studies.** Carsten, A.L.; Benz, R.D.; Hughes, W.P.; Ichimasa, Yusuke; Ikushima, Takaji; Tezuka, Hideo. (Brookhaven National Lab., Upton, NY (USA)). 1988. Contract AC02-76CH00016. 12p. (CONF-881190—2). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004530/JAW.

From 3. Japan-US workshop on tritium radiobiology and health physics; Kyoto, Japan (8 Nov 1988).

A number of years ago a multiparameter program to evaluate the toxicity of tritiated water (HTO) was undertaken in the Medical Department at Brookhaven National Laboratory. The results of most of these studies have been published and will receive brief attention. Emphasis will be placed on the unpublished studies involving the induction of sister chromatid exchanges (SCE's) in bone marrow of mice, new biochemical information, and preliminary results on lifetime-shortening and carcinogenesis. In brief, male Hale-Stoner Brookhaven (HSB) mice maintained on HTO concentrations ranging from 3.0 to 30.0 μCi/ml exhibited essentially the same number of SCE's per cell throughout their lifetime. Control mice showed a decrease in number of SCE's with age. The lack of a dose-response effect and the constant level of SCE's in HTO mice as compared to controls will be discussed. In the carcinogenesis study C57BL/6J male mice received various x-ray or HTO regimens. Mortality data from these and other studies in which CBA/Ca/BNL mice received single x-ray exposures or equivalent integrated dose exposures by single HTO injections will be discussed. 25 refs., 4 figs.

11895 **(CEA-R—5462) Radiation-induced cancers in the rat, an experimental study.** Morin, M.; Lafuma, J. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Protection Sanitaire). Sep 1988. 56p. (In French). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88756239/JAW.

Radiation carcinogenesis at low doses raises a major radiological protection problem; we have attempted to deal with it through animal investigations involving over 3,000 rats. For various radiation types, dose-effect relationships as well as possible synergies with endogenous or exogenous chemical factors were studied. The chief problem being the possibility of extrapolation to man, a comparison was made between man and rat with the only human data available from radon inhalation in uranium miners.

11896 **(CNIC—00080) Radiation damage, treatment of tumor and acute benzene toxicosis effects of superoxide dismutase (SOD).** Jiang Jiagui; Lin Xingcheng; Zhu Yuyu. (Suzhou Medical Coll., JS (China)). (China Nuclear Information Centre, Beijing, BJ). Sep 1987. 7p. (In Chinese). (SMC—0009). NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS. Order Number DE88705241/JAW.

The protective effects of SOD on irradiated-mice were studied by white cell counts, determination of taurine in urine, and survival of irradiated-animals. The enzyme was protective against radiation-induced inhibition of lymphocyte blastogenesis. The protective effect of SOD on patients suffered from cancer was also studied by white cell counts. The effect of SOD on white cell counts in mice of benzene toxicosis was also discussed.

11897 **(CONF-880514—6) Bone surface deposition of ^{241}Am in a person with occupational exposure.** Schlenker, R.A.; Oltman, B.G.; Kathren, R.L. (Argonne National Lab., IL (USA)). 1988. Contract W-31109-ENG-38. 19p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89003975/JAW.

From Workshop on biological assessment of occupational exposure to actinides; Versailles, France (30 May 1988).

We have measured the ^{241}Am concentrations in the vicinity of bone surfaces in 11 samples of cortical bone from a man whose occupational exposure occurred 25 to 27 years before death. Concentrations in bone surface deposits ranged between 44 and 185 Bq/cm^3; concentrations in subjacent bone ranged between 0 and 8.4 Bq/cm^3. Thicknesses of the bone surface deposits were in the range 0.6 to 1.2 μm. An analysis of dose rates indicates that bone surface deposits contributed 40% or more of the terminal dose rate to bone surface tissues. Half-lives for the reduction of bone surface concentrations are estimated at 4.8 to 24 years, compared with the 100-year estimates obtained by using current ICRP methodologies. These data are important for the estimation of the dose rate to bone surface tissues for radiation protection. 10 refs., 3 figs., 1 tab.

11898 **(CONF-8810248—1) External radiation doses received by female radium dial painters.** Rowland, R.E.; Lucas, H.F.; Schlenker, R.A. (Argonne National Lab., IL (USA)). 1988. Contract W-31109-ENG-38. 16p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89003656/JAW.

From NCI-DOE-CEC workshop on risks from radium and thorium; Bethesda, MD, USA (3 Oct 1988).

While almost all the studies of the dial painters have concentrated on their internally deposited radium, the dial painters also received an external dose from the gamma rays emitted by radium and its daughter products. Each painter worked with a container of paint containing radium in front of her, and a collection of finished dials beside her. Each work station then was a radiation source, and each painter in the room was irradiated by her own sources of radium in front of her, by the radium on every other work station in the room, and by the radium contamination on the floors and desks. Each day that a painter worked she would have received a dose from these external sources which was unrelated to her internally deposited radium, but dependent on her work place. It is the purpose of this study to estimate the external dose in the work place, to determine the dose received from these external sources for each female dial painter from the length of time she worked, and to examine the relationship between external dose and the causes of death.

11899 **(DOE/ER/60464—3) Direct assays of radiation-induced DNA base lesions in mammalian cells: Technical progress report, July 1, 1986--December 1, 1988.** Wheeler, K.T. Jr. (Bowman Gray School of Medicine, Winston-Salem, NC (USA). Dept. of Radiology). 1988. Contract FG05-86ER60464. 7p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005386/JAW.

Our cesium irradiator was installed in April 1987 and has the capability of irradiating DNA solutions, cells and animals at dose rates from >60 Gy/min to <10/sup {minus}2/ Gy/min. By early summer all of the dosimetry and set-ups were established to perform this research. In may 1987, Dr. Krystyna Lesiak left to return to the National Institutes of Health. However, she has remained a collaborator over the past 1{1/2} years. She has synthesized a large lot of α-deoxyadenosine, isolated a large batch of both the R and S isomer of cyclodeoxyadenosine and has capped the α-deoxyadenonsine for use in a DNA synthesizer that uses phosphoramidite chemistry. In November 1987, Dr. Andrzej Surowiec joined our unit as a Visiting Research Assistant Professor. Dr. Surowiec has a MS degree in electrical engineering and did his Ph.D. in Biophysics studying the conductivity of DNA in dilute solution. He has been performing the helix-coil transition experiments. In November 1987, Dr. Steven Swarts also joined our unit as a Postdoctoral Fellow. He received his Ph.D. from Oakland University under Dr. Michael Sevilla with whom we have a collaboration studying the induction of base damage in hydrated DNA. Dr. Swarts has a strong background in spectroscopy and, therefore, was a key individual for determination of the limitations of the HPLC assays and the establishment of a GC/MS capability equivalent to Dr. M. Dizdaroglu at the National Bureau of Standards. 9 refs., 1 tab.

11900 **(DOE/FTR—9005071) [3rd international symposium on neutron capture therapy, Bremen, West Germany, visit to Radcliffe Infirmary, Oxford, England, and visit to Atomic Energy Research Establishment, Harwell, May 29--June 8, 1988]: Foreign trip report.** Fairchild, R.G.; Coderre, J.A.; Joel, D.D.; Kalef-Ezra, J.; Laster, B.H.; Miura, M. (Brookhaven National Lab., Upton, NY (USA)). 27 Jun 1988. Contract AC02-76CH00016. 6p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005071/JAW.

The 3rd International Symposium on NCT was a successful and well-organized meeting, with 95 papers presented. Highlights were the three patients treated for malignant melanoma with BNCT in Japan; a continuation of glioblastoma treatments in Japan (~100); a description of new proposed patient treatment port (10-H facility) using Al/S/Ar at the 25 MW DIDO/PLUTO reactors at the Harwell Laboratory; and the initiation of phase I clinical trials (pharmacokinetics of BSH) at Radcliffe Infirmary, Oxford. The visit to Radcliffe and Harwell revealed a competent, enthusiastic, and well-qualified multidisciplinary team well advanced in the pur-

suit of clinical trials of NCT. In the 10-H facility at the 25 MW DIDO reactor, the group has access to a powerful and versatile beam port, which should produce a usable beam with the Al/S/Ar filter. This group is interested in investigating the suitability of both BSH and p-boronophenylalanine for BNCT of glioma and melanoma, respectively. Discussions with Dr. R. Moss, Petten Establishment, The Netherlands, indicated that some funds has been made available by the Commission of the European Communities for the development of an epithermal beam at the reactor at Petten. Discussions with Drs. Riaboukhine and Spryshkova (USSR) indicated an interest and willingness to initiate collaborative studies of mutual benefit.

11901 **(EGG-M—88039) The effects of ionizing radiation and dexamethasone on the blood-brain-barrier (BBB) and blood-tumor-barrier (BTB): Implications for boron neutron capture therapy (BNCT) of brain tumors.** Dorn, R.V. III; Spickard, J.H.; Griebenow, M.L. (EG and G Idaho, Inc., Idaho Falls (USA)). 1988. Contract AC07-76ID01570. 8p. (CONF-8805150—2). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005175/JAW.

From 4. international conference on neutron capture therapy; Bremen, F.R. Germany (31 May 1988).

Currently envisioned techniques for Boron Neutron Capture Therapy (BNCT) of brain tumors rely on the increased permeability of the blood-brain-barrier (BBB) (more specifically, the blood-tumor-barrier (BTB)) which occurs around the malignant tumor. As a result of this increased permeability, higher boron concentrations ($Na_8B_{12}H_{11}SH$) should be obtainable in the tumor than in the surrounding normal brain. The effects on the BBB and BTB by the ionizing component of this radiation and by the steroid dexamethasone (almost universally used in the clinical management of these patients) must be considered in the formulation of this treatment technique. 32 refs., 5 tabs.

11902 **(GSI—88-33-Prepr.) On the interpretation of radiobiological experiments performed with heavy charged particles.** Kraft, G. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.)). Jul 1988. 22p. (CONF-8806231—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756355/JAW.

From International Atomic Energy Agency (IAEA) advisory group meeting on atomic and molecular data for radiotherapy; Vienna, Austria (13 Jun 1988).

In heavy ion experiments, a large body of radiobiological data, (cross sections for cell inactivation and mutation, induction of both chromosome aberrations, and of strand breaks of DNA) has been measured for different atomic numbers, from helium (Z=2) to uranium (Z=92), and at energies between 1 and 1000 MeV/u which covers an LET range from 10 to 16000 keV/μm. These data exhibit a common feature: At LET values below 100 keV/μm all data points of one specific effect form one single curve as a function of LET, independent of the atomic number of the ion. In this LET range, the biological effects are independent from the particle energy or track structure and depend only on the energy transfer. Therefore, LET is a good parameter in this regime. For LET values greater than 100 keV/μm, the curves for the different ions separate from the common curve in order of increasing atomic numbers. In this regime LET is no longer a good parameter and the physical parameters of the formation of particle tracks are important. The similarity of the σ-LET curves for different endpoints shows that the 'hook-structure' is produced by physical and chemical effects which occur before the biologically relevant lesions are formed. For this part of the reaction chain only a very limited amount of data is available. This is especially true for the emission of delta electrons. There, the energy and angular distribution of the electrons and the positive deficiencies are required. The energy dependence of the production of chemical lesions should be known as well as their recombination probabilities.

11903 **(GSI—88-52-Prepr.) Cellular and subcellular effect of heavy ions: A comparison of the induction of strand breaks and chromosomal aberration with the incidence of inactivation and mutation.** Kraft, G.; Kraft-Weyrather, W.; Ritter, S.; Scholz, M.; Stanton, J. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.)). Oct 1988. 14p. (CONF-8807140—). Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.).

From 11. COSPAR symposium on cosmic ray studies in space; Helsinki, Finland (18 Jul 1988).

Radiobiological effects of heavy charged particles are compared for a large variety of ions from Helium to Uranium and energies between 1 and 1000 MeV/u which correspond to LET values between 10 and 16000 keV/μm. The different cross section for the induction of strand breaks and chromosomal aberrations as well as for inactivation and mutation induction exhibit striking similarities when compared as function of the linear energy transfer (LET). At LET values below 100 keV/μm all data points of one specific effect form one single curve as a function of LET, independent of the atomic number of the ion. In this LET range, the biological effects are independent from the particle energy or track structure and depend only on the energy transfer. Therefore, LET is a good parameter in tis regime. For LET values greater than 100 keV/μm, the curves for the different ions separate from the common curve in order of increasing atomic numbers. In this regime LET is no longer a good parameter and the physical parameters of the formation of particle tracks are important. The similarity of the σ-LET curves for different endpoints indicates that the 'hook-structure' is produced by physical and chemical effects which occur before the biologically relevant lesions are formed. However, from the existing data of biological effects, it can be concluded that the efficiencies for cell killing are always smaller than those extrapolated from X-ray data on the basis of the energy deposition only. Therefore, cells which are directly hit by an HZE particle are not killed and undergo a finite risk of mutation and transformation.

11904 **(GSI—88-53-Prepr.) Cell cycle delays induced by heavy ion irradiation of synchronous mammalian cells.** Scholz, M.; Kraft-Weyrather, W.; Ritter, S.; Kraft, G. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.)). Oct 1988. 7p. (CONF-8807140—). Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.).

From 11. COSPAR symposium on cosmic ray studies in space; Helsinki, Finland (18 Jul 1988).

Cell cycle effects of very high LET particles on synchronous V79 Chinese Hamster cells have been studied in a track segment experiment by means of flow cytometric methods. Cells were irradiated with 10 MeV/u Pb-ions (LET=13500 KeV/μm) at an average fluence of 2 particles per cell nucleus, corresponding to a survival level of about 25%. Instantaneous drastic reductions of cell proliferation in all cycle phases have been observed, which affect the cell cycle for at least 50 hours after exposure to heavy ions. These findings are in clear contrast to the results from low LET radiation experiments, where significant delays can only be observed in S-phase and G/sub 2/M-phase and for comparatively short time intervals of a few hours. Additionally, high LET radiation gives rise to prolonged DNA synthesis bypassing cell division, which leads to cells with DNA content greater than that of G/sub 2/M-cells.

11905 **(INFO—0202) Radiation protection: precedents, principles and practices - a regulatory viewpoint.** Jennekens, J.H. (Atomic Energy Control Board, Ottawa, Ontario (Canada)). Jun 1986. 8p. (CONF-8606422—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88705126/JAW.

From Annual conference of the Canadian Radiation Protection Association; Saint John, Canada (11 Jun 1986).

Radiation protection in its broadest sense is a multidisciplinary human function exemplifying in all meaningful respects the innate ability of dedicated persons to apply with both general and specialized expertise knowledge derived from a great many scientific and technical fields. The aim of this address is to outline from a regulatory viewpoint the precedents, principles and practices of radiation protection, a very essential human function.

11906 (INIS-mf—11879) 57Co-bleomycin and *I-bleomycin in Ehrlich's carcinoma model of the mouse. Tumour concentration, organ distribution, whole body retention and stability. Sueck, P. (Freie Univ. Berlin (Germany, F.R.)). 5 Jul 1983. 54p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88756372/JAW.

The tumour concentration, distribution of activity and whole body retention of bleomycin labeled with iodine-125 or iodine-131 was contrasted with that of 57Co-bleomycin following administration to mice showing tumours. Additional investigations were carried out to determine the stability of iodinated bleomyin in vivo and in vitro. As regards the beahaviour of I-bleomycin in mice showing solid carcinomas according to Ehrlich it was established that its absolute tumour concentration was lower and its relative tumour concentration just slightly less pronounced than that of 57Co-bleomycin during the period between 2 and 48 hours following administration. Investigations into whole body retention showed the elimination of activity to be more rapid for 131I-bleomycin as compared to 57Co-bleomycin. Bleomycin that was radioiodinated according to the iodine monochloride method proved to be more stable in vivo than bleomycin labeled with 57Co. Further studies, in particular clinical trials, will have to be carried out before definite conclusions can be drawn as to the diagnostic value of radioiodinated bleomycin in tumour localisation. (TRV).

11907 (IPEN-Pub—142) Effects of radiolysis products on crotamine (toxin from Crotalus durissus terrificus venom). Costa, T.A. da; Rogero, J.R. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo, SP (Brazil)). Jul 1988. 11p. (In Portuguese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704156/JAW.

Ionizing Radiations changes the molecular structure due to chemical bond destruction. These chemical alterations are able to change the biological properties of the biomolecules. Crotamine was obtained from Crotalus durissus terrificus venom by molecular exclusion cromatography and irradiated in a concentration of 1 mg/ml in aqueous solution with gamma radiation produced by a / sup 60/Co source. We used doses of 100 Gy, 2000 Gy and 5000 Gy (dose rate = 1,14 x 10/sup 3/ Gy/h). We performed the following experiments: proteic concentration, SDS-PAGE and immunodiffusion. Preliminary results showed a reduction of 55% in proteic concentration; with dose of 5000 Gy; an increase of the number of bands in SDS-PAGE suggesting the appearance of protein aggregates that was proportional as the dose increases. The immunodifusion data showed a reduction of the immunochemical activity against the Butantan antisera.

11908 (PB—89-119713/XAB) Physicochemical studies of the interactions between chemical radio protectors and membranes of the biological type. Final report. Berleur, F. (CEA, Paris (France). Dept. de Physico-Chimie). 16 Apr 1986. 174p. (In French). NTIS, PC E08/MF E08.

The report discusses an investigation by magnetic resonance and differential calorimetry of the structure of the model membranes, and of the chemical - lipid chemical radio protector interactions. It also includes analysis of the results in structure - reactivity terms.

11909 (PNL—6584-Vol.2) GENII: The Hanford Environmental Radiation Dosimetry Software System: Volume 2, Users' manual: Hanford Environmental Dosimetry Upgrade Project. Napier, B.A.; Peloquin, R.A.; Strenge, D.L.; Ramsdell, J.V. (Pacific Northwest Lab., Richland, WA (USA)). Nov 1988. Contract AC06-76RL01830. 204p. NTIS, PC A10/MF A01 - OSTI. Order Number DE89004445/JAW.

The Hanford Environmental Dosimetry Upgrade Project was undertaken to incorporate the internal dosimetry models recommended by the International Commission on Radiological Protection (ICRP) in updated versions of the environmental pathway analysis models used at Hanford. The resulting second generation of Hanford environmental dosimetry computer codes is compiled in the Hanford Environmental Dosimetry System (Generation II, or GENII). The purpose of this coupled system of computer codes is to analyze environmental contamination of, air, water, or soil. This is accomplished by calculating radiation doses to individuals or populations. GENII is described in three volumes of documentation. This second volume is a Users' Manual, providing code structure, users' instructions, required system configurations, and QA-related topics. The first volume describes the theoretical considerations of the system. The third volume is a Code Maintenance Manual for the user who requires knowledge of code detail. It includes logic diagrams, global dictionary, worksheets, example hand calculations, and listings of the code and its associated data libraries. 27 refs., 17 figs., 23 tabs.

11910 (PNL-SA—13972) Possible role of ELF [extremely low frequency] fields in leukemogenesis. Stevens, R.G. (Pacific Northwest Lab., Richland, WA (USA)). Dec 1988. Contract AC06-76RL01830. 7p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005535/JAW.

This report presents a biological rationale for a possible role of ELF (extremely low frequency electric and/or magnetic) fields in the etiology of leukemia. The hypothesis is based on three lines of evidence: ELF fields may increase calcium efflux from cells, the intracellular concentration of oxygen radicals may increase as a result of increased calcium efflux, and certain leukocytes may be at exaggerated risk of oxidative damage resulting from increased calcium efflux because they produce oxygen radicals to do their job. An increase in the concentration of oxygen radicals may increase mutation to DNA and thereby increase risk of transformation. 23 refs.

11911 (PNL-SA—15899) Use of mammalian cells to investigate the genetic consequences of DNA damage induced by ionizing radiation. Morgan, T.L.; Fleck, E.W.; Poston, K.A.; Denovan, B.A.; Newman, C.N.; Rossiter, B.J.F.; Miller, J.H. (Pacific Northwest Lab., Richland, WA (USA)). Dec 1988. Contract AC06-76RL01830;AM06-70RL02225. 18p. (CONF-8810209—8). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005157/JAW.

From 27. Hanford life sciences symposium on health and the environment; Richland, WA, USA (18 Oct 1988).

The present work was conducted to determine the effects of cellular repair processes on the spectrum of mutations induced in CHO-K1 cells. We investigated the effects of dose, delayed replating and dose fractionation on the yield, type and position of mutations induced at the HPRT locus by 250 kVp X rays. Dose was the only parameter which showed a statistically significant effect on the mutation spectrum. At 2 Gy the fraction of mutants containing complete deletions of the gene was less than that observed with a dose of 4 Gy. 22 refs., 1 fig., 2 tabs.

11912 (UCRL—100095) New approaches for the biological monitoring of radiation workers. Mendelsohn, M.L. (Lawrence Livermore National Lab., CA (USA)). Dec 1988. Contract W-7405-ENG-48. 13p. (CONF-8810258—1). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004884/JAW.

From Electric Power Research Institute workshop; San Diego, CA, USA (18 Oct 1988).

Methods for the measurement of somatic mutation and chromosome aberration in the human are currently advancing, and provide important new opportunities for the biological dosimetry of nuclear workers. Methods to test somatic mutation in four human genes (hprt, hla, glycophorin {Alpha} and β globin) are reviewed briefly and evaluated for their applicability to biological radiation dosimetry of nuclear workers. Two somatic mutation tests can be currently recommended: an HPRT method applied to recently exposed workers, and the glycophorin {Alpha} method applied to workers exposed over their working lifetime. A new method of chromosome analysis using DNA hybridization with chromosome-specific gene libraries allows one to paint single or multiple chromosome pairs in standard metaphase preparations. This method is ideal for the rapid and reliable detection of reciprocal translocations, the key lesion for the evaluation of long-term radiation exposure. Both mutational and aberrational approaches should be fostered in the expectation that they will complement other forms of dosimetry and will improve our ability to clarify whether or not significant health effects are dosimetrically related. 40 refs.

11913 **Plutonium, Am, Cm and Sr in ducks maintained on radioactive leaching ponds in southeastern Idaho.** Markham, O.D.; Halford, D.K.; Rope, S.K.; Kuzo, G.B. (Department of Energy, Idaho Falls, ID (USA)). *Health Physics;* **55**: No. 3, 517-524(Sep 1988).

Concentrations of 90Sr, 238Pu, 239,240Pu, 241Am, 242Cm and 244Cm were determined in tissues of mallard ducks (Anas platyrhynchos) maintained for 43-145 d on radioactive leaching ponds in southeastern Idaho. Highest concentrations of transuranics occurred in the gastrointestinal tract, followed closely by feathers. Approximately 75%, 18%, 6% and 1% of the total transuranic activity in tissues analyzed were associated with the bone, feathers, GI tract and liver, respectively. Concentrations in GI tracts were similar to concentrations in vegetation and insects in the littoral area of the ponds. The calculated total dose rate to the ducks from both 90Sr and the transuranic nuclides was 0.69 mGy d-1 (69 mrad d-1), of which 99% was to the bone. The potential effective dose equivalent to a human consuming the entire muscle and liver mass of one experimental duck with average nuclide concentrations was 0.46 microSv (0.046 mrem). Based upon average concentrations in experimental ducks and on surveys of wild waterfowl using this area, a conservative estimate of transuranic activity exported by wild ducks using the ponds during one year was 11.3 kBq (305 nCi). Similarly, the total amount of 90Sr exported in muscle, bone and lung of wild ducks in one year was 2.5 MBq (68.7 microCi).

11914 **Neutron personnel dosimetry intercomparison studies at the Oak Ridge National Laboratory: a summary (1981-1986).** Swaja, R.E.; Sims, C.S. (Oak Ridge National Lab., TN (USA)). *Health Physics;* **55**: No. 3, 549-564(Sep 1988).

To provide an opportunity for dosimetrists to test and calibrate their neutron personnel monitoring systems, the staff of the Dosimetry Applications Research (DOSAR) Facility at the Oak Ridge National Laboratory (ORNL) has conducted personnel dosimetry intercomparison studies (PDIS) periodically since 1974. During these studies, personnel dosimeters are mailed to ORNL, exposed to low-level (less than 15 mSv) neutron dose equivalents in a variety of mixed-radiation fields, and then returned to the participants for evaluation. These intercomparisons have provided more data on neutron dosimeter performance than any other periodic test program conducted to date. This report presents a summary and analysis of about 3450 neutron dose equivalent measurements reported for PDIS 7 through 12 (1981-1986) with emphasis on low dose equivalent sensitivity, accuracy and precision, and performance relative to accreditation standards for the basic types of personnel dosimetry systems. Relationships of the PDIS results to occupational neutron monitoring, accreditation testing, and methods to improve personnel neutron dosimetry performance are also discussed.

5602 Thermal Effects

11915 **(SNV—3355) Epilithic algal assemblages in the Forsmark Biotest basin.** Snoeijs, P. (Uppsala Univ. (SE). Dept. of Ecological Botany). (National Swedish Environmental Protection Board, Solna). Apr 1987. 85p. NTIS (US Sales Only), PC A05/MF A01. Order Number DE88755858/JAW.

The Forsmark Biotest Basin is an artificial offshore brackish lake, through which the cooling water is led from the Forsmark Nuclear Power Station on the Swedish east coast. The Biotest Basin differs from the Bothnian Sea surrounding it by a temperature elevation of up to 10 degrees C, no ice cover in winter, and an artificial, fast current. At 11 sites in- and outside the basin, benthic algal assemblages on stones in the hydrolittoral belt were sampled every third week during one year. Cover abundances were estimated for all algae occurring on the stones, but for diatoms only when they formed blooms. The results of the vegetation analyses are given. Diversity indices and dominance-diversity curves were computed for each site on the basis of pooled data for the cold season and for the rest of the year. The algae included both unicellular and multicellular forms. In total 88 taxa were distinguished in the species lists: 29 Cyanophyta, 7 Rhodophyta, 1 Chrysophyceae, 9 Fucophyceae, 17 Diatomophyceae and 25 Chlorophyta. In terms of percentage cover-abundance, blue-green and green algae increased with temperature, while red and brown algae and diatoms decreased with temperature in the interval between the minimum (0 degrees C) and the maximum (25.7 degrees C) water temperatures that were measured during the investigation period. Melosira spp. and Nitzschia filiformis proved to be the diatoms most favoured by the cooling water discharge. Lower diversity and greater dominance of one or a few species over the other was caused by thermal discharge at sites with fast-flowing water, but the opposite occurred at sites with quiescent water, mainly due to a greater number and higher abundances of blue-green algal species and thread-like green algae at the latter sites. This report also gives some notes on taxonomy of the encountered species.

5603 Chemicals Metabolism And Toxicology

REFER ALSO TO CITATION(S) 11707, 11731

11916 **(CEA-R—5468) Contribution to the study on the mutagenicity of atmospheres.** Blaise, P. (CEA Etablissement de la Vallee du Rhone, 26 - Pierrelatte (FR). Service d'Hygiene Industrielle). (Montpellier-2 Univ., 34 (France)). 1988. 242p. (In French). NTIS (US Sales Only), PC A11/MF A01. Order Number DE88756329/JAW.

Following a review of the literature, the genotoxic hazards of atmospheric pollutants at various locations (rural sites, motorway tolls, paint shops,...) were evaluated by in vitro mutagenecity assays (Ames' test and SOS chromotest) and analytical methods (gas chromatography and mass spectrometry). Instrumentation and procedures were developed for the sampling of volatile organic pollutants: adsorption on XAD/sub 2/ followed by acetone extraction of the compounds trapped. A comparative study allowed to assess the relative mutagenic action of the volatile organic compounds and to establish a mutagenicity scale.

11917 **(CONF-8811124—1) Organic chemicals in breast milk: Risks to the infant.** Travis, C.C. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 24p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89002207/JAW.

From Conference on risks of toxic substances in developing countries: implications for women and children; Bangkok, Thailand (18 Nov 1988).

Special dietary needs will be addressed, including dependence of the infant on milk, in this paper, focusing on the chemicals that traverse the mammary glands in lactation, and expose the infant to unwanted risks. The potential adverse effects from maternal exposure to chemicals on breast-fed infants is an area of growing concern. Infants and young children are more vulnerable to the adverse effects of chemicals than adults for several additional reasons: They include: larger body surface area in relation to weight; higher metabolic rate and oxygen consumption and hence greater intake of air per unit body weight; different body composition; and greater energy and fluid requirements per unit body weight. 64 refs., 2 figs., 2 tabs.

11918 **(DOE/ER/60588—2) The impact of energy-related pollutants on chromosome structure: Progress report, May 1, 1988--April 30, 1989.** Rill, R.L. (Florida State Univ., Tallahassee (USA). Inst. of Molecular Biophysics). [1989]. Contract FG05-87ER60588. 7p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005269/JAW.

We have examined, at the DNA sequence level, the sequence preferences of binding of six chemicals to linear DNA. The chemicals utilized were the bis-(1,10)-phenanthroline Cu(I) complex [$(Phen)_2Cu^+$], (+)-anti-and ({minus})-anti isomers of benzo(a)pyrene-7,8-diol-9, 10-epoxide (BPDE), acetylacetoxyaminofluorene (AAAF), 8-azido-ethidium (AEt), and 7-azido-actinomycin D (AAct D). Mapping of binding sites depends on the abilities of these chemicals to either spontaneously cleave DNA, as in the case of $(Phen)_2Cu^+$, or to create alkali-labile base adducts, as in the cases of the other chemicals. The techniques utilized are analogous to those of DNA sequencing. Binding sites were mapped in sea urchin and mouse histone genes cloned into pUC plasmids. Mapping has now been performed on 1000--2000 bases for all of the chemicals excepting AAAF. All six chemical exhibit distinct sequence preferences. Preferences are notable at the level of doublets, but in all

cases the preferences are strongest at the levels of triplets or quartets. Some evidence has been obtained for preferences that extend beyond quartets. The most preferred sequences are different for all five chemicals examined in detail. Perhaps most interesting are the differences in specifications noted for the anti-(+) and anti-({minus}) isomers of BPDE.

11919 **(GSF—28/87) Survey of bioassays and other test systems for environmental monitoring and detection of unexpected changes in the environment. Bioprobes - biological indicators, chemicals testing systems, scientific research on biological indicator systems. Pt. 1. Requirements on bioprobes and results of an inquiry.** Peichl, L.; Reiml, D.; Ritzl, I.; Schmidt-Bleek, F. (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H. Muenchen, Neuherberg (Germany, F.R.). Projektgruppe Frueherkennung von Umwelt- und Gesundheitsschaeden (PFU)). Dec 1987. 101p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88756191/JAW.

A survey on bioprobes, chemicals test systems from which bioprobes can be developed and research subjects which comprise attempts at a development of bioprobes was carried out from June to October 1987. About 5000 scientists in the FRG, in German-speaking countries as well as in the Netherlands were asked to contribute to this. 112 answers could be analyzed: 49 bioprobes, 30 chemicals test systems developable to bioprobes and 33 research subjects which can contribute to the development of bioprobes. The paper on hand presents a survey on the known scientific attempts and the present state of the development of different bioprobes in German-speaking countries. The study proves that the required development of bioprobes can rely on a broad basis of existing knowledge.

11920 **(NP—9770186) Effects of air pollution on soil, water, flora and fauna.** (Bundesamt fuer Ernaehrung und Forstwirtschaft, Frankfurt am Main (Germany, F.R.)). Jun 1987. 272p. (In German). NTIS (US Sales Only), PC A12. Order Number DE89770186/JAW.

The report is to show the accumulation of air pollutants in soils and waters as well as the changes and impairments resulting therefrom. In addition to this, it describes the contamination and the damaging or impairment of useful plants and wild plants, domestic animals and wild animal species. The description covers qualitative and quantitative determination of damages, listing of individual pollutants, explanation of the effects of the pollutants, consideration of combination effects, effects on the ecosystems and pollution effects; preventive measures and recommendations for use are finally dealt with as far as they are already practiced or under discussion. The most important findings and results are evaluated in a final conclusion.

11921 **(NP—9770206) Weather-dependent, seasonal periods of enhanced soil acidification in the soil of two forest ecosystems.** Cassens-Sasse, E. (Goettingen Univ. (Germany, F.R.). Forschungszentrum Waldoekosysteme - Waldsterben). 1987. 295p. (In German). NTIS (US Sales Only), PC A13/MF A01. Order Number DE89770206/JAW.

In two different forest sites with spruce and beech trees, the author examined how strongly soil acidification may influence the stability of forest ecosystems. Deposition was measured as well as soil chemical parameters and biological productivity. The results show that both acid deposition and internal soil acidification increase the degree of a greater instability of this terrestrial ecosystem.

11922 **(PB—89-108997/XAB) Assess health effects associated with dichloromethane (methylene chloride). Final report.** (Environmental Protection Agency, Washington, DC (USA). Science Advisory Board). 9 Mar 1988. 9p. (SAB-EHC—88-013). NTIS, PC A02/MF A01.

See also PB—84-162643.

On August 13-14, 1987 the Halogenated Organics Subcommittee of the Science Advisory Board's Environmental Health Committee met in Washington, D.C. to review two documents prepared by EPA's Office of Research and Development that assess health effects associated with dichloromethane (methylene chloride). The documents included: a June 1987 Draft Technical Analysis of New Methods and Data Regarding Dichloromethane: Pharmacokinetics, Mechanism of Action and Epidemiology, a July 1987 Draft Addendum to the Health Assessment Document for Dichloromethane: Pharmacokinetics, Mechanism of Action and Epidemiology. The Subcommittees concluded that the Addendum was one of the best documents it has received in terms of its clarity, coverage of the data and analysis of scientific issues. The document clearly demonstrates the potential utility of pharmacokinetics data in risk assessment.

11923 **(PB—89-109003/XAB) Review of the Office of Drinking Water's draft final-criteria document for ortho-meta-para-dichlorobenzene.** (Environmental Protection Agency, Washington, DC (USA). Science Advisory Board). 9 Mar 1988. 7p. (SAB-EHC—88-016). NTIS, PC A02/MF A01.

See also PB—86-117918.

The Halogenated Organics Subcommittee of the Science Advisory Board's Environmental Health Committee completed its review of the Office of Drinking Water's Draft Final Criteria Document for ortho-meta-para-dichlorobenzene. The U.S. Environmental Protection Agency has used the weight of evidence approach in recommending a classification of B2 for drinking water based on existing animal studies. The Subcommittee concluded that the reasoning offered for the conclusion is scientifically defensible, but it is not the only defensible conclusion. In assessing the issue of carcinogenicity, a key question is the weight that should be assigned to the rat data. For purposes of this and other issues, most Subcommittee members concluded that the compound should more appropriately be classified as Category C of U.S. Environmental Protection Agency guidelines.

11924 **(PB—89-109011/XAB) Review of the acrylamide health criteria document. Final report.** (Environmental Protection Agency, Washington, DC (USA). Science Advisory Board). 19 Jul 1988. 7p. (SAB-EHC—88-035). NTIS, PC A02/MF A01.

See also PB—86-117744.

The Drinking Water Subcommittee of the Science Advisory Board's Environmental Health Committee completed its review of the Drinking Water Health Criteria Document for Acrylamide. The Subcommittee made the following conclusions and recommendations: because it was performed for two full years, the Johnson Study should be used in setting the standard; the final assessment of the carcinogenic potential should await the results of the current bioassay, the ability of acrylamide to produce heritable germ-cell mutations should be given emphasis in the risk-assessment process; the health implications of products formed from acrylamide as a result of chlorination and oxidation processes are potentially serious and must be considered in the document; and the potential effects of pH and metal ions in water should be addressed.

11925 **(PB—89-109029/XAB) Review of the selenium health criteria document. Final report.** (Environmental Protection Agency, Washington, DC (USA). Science Advisory Board). 19 Jul 1988. 6p. (SAB-EHC—88-036). NTIS, PC A02/MF A01.

See also report dated Apr 1985, PB—86-118098.

The Metals Subcommittee of the Science Advisory Board's Environmental Health Committee has completed its review of the Drinking Water Health Criteria Document for Selenium. The Subcommittee made two recommendations; that more information was needed in the document on the studies on which the standard is based, and that the Drinking Water Equivalent Level (DWEL) should be 200 micrograms/L based on an uncertainty factor of 10. The Committee observed that the Environmental Protection Agency for its suggested drinking-water equivalent level has chosen a factor 15 and are to be able to balance the data from Yang et al. (1983) and the National Academy of Sciences 1980 conclusion that the safe range of daily selenium intake if 50 to 200 microgram. The Subcommittee further recommended that because the Yang et al. study and the National Academy of Sciences recommendation plays such an important role in the development of the drinking-water-equivalent level, more detail be more redefined concerning these studies.

11926 **(PB—89-109607/XAB) Science Advisory Board's review of the ethylbenzene health-criteria document. Final report.** (Environmental Protection Agency, Washington, DC (USA). Science Advisory Board). 19 Jul 1988. 7p. (SAB-EHC—88-033). NTIS, PC A02/MF A01.

See also PB—86-117835.

The Drinking Water Subcommittee of the Science Advisory Board's Environmental Health Committee completed its review of the Drinking Water Health Criteria Document for Ethylbenzene, dated March 1987. The review was conducted February 4-5, 1988, at the Washington, Circle Hotel in Washington, D.C. The Subcommittee made the following conclusions and recommendations: the use of study by Wolf et al. is acceptable in calculating the drinking-water-equivalent level; since the proposed drinking-water-equivalent level is greater than the odor and taste threshold, a secondary should be set for ethylbenzene; further research is needed regarding interaction with other toxics such as acrylonitrile and xylene; and classifying ethylbenzene as group D on weight of evidence in sound and exposure section is incomplete and misleading.

11927 **(PB—89-118327/XAB) Health and environmental effects profile for 2-methoxyethanol acetate.** (Environmental Protection Agency, Cincinnati, OH (USA). Office of Environmental Criteria and Assessment). Apr 1987. 50p. (EPA—600/X-87/158). NTIS, PC A03/MF A01.

The Health and Environmental Effects Profile for 2-methoxyethanol acetate was prepared to support listings of hazardous constituents of a wide range of waste streams under Section 3001 of the Resource Conservation and Recovery Act (RCRA) and to provide health-related limits for emergency actions under Section 101 of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). Both published literature and information obtained from Agency program office files were evaluated as they pertained to potential human-health, aquatic-life and environmental effects of hazardous-waste constituents. 2-methoxyethanol acetate has been determined to be a systemic toxicant. The daily exposure to the human population (including sensitive subgroups) that is likely to be without appreciable risk of deleterious effect during a lifetime, for 2-methoxyethanol acetate is 0.002 mg/kg/day for inhalation exposure. The Reportable Quantity (RQ) value for 2-methoxyethanol acetate is 100.

11928 **(PB—89-119739/XAB) Summary review of the health effects associated with propylene: health issue assessment.** (Environmental Protection Agency, Research Triangle Park, NC (USA). Environmental Criteria and Assessment Office). Jul 1988. 37p. (ECAO-R—0083). NTIS, PC A03/MF A01.

Propylene's major use is as a starting material in the manufacture of polypropylene, acrylonitrile, propylene oxide, and as a component in fuel. Ambient concentrations in urban areas of the United States range from about 1 to 10 ppb, with rural air levels being an order of magnitude lower. Propylene is a precursor of photochemical oxidants and other smog components. The atmospheric half-life has been estimated to be 7.7 hours. Propylene is readily metabolized following inhalation exposure. Limited data from acute studies (exposure to a 40% concentration for 6 hours) indicate that propylene is not very toxic to rats. Similarly, no compound-related toxic effects were found in subchronic studies with exposure levels up to 10,000 ppm. Propylene was not carcinogenic in the NTP rat and mice studies with exposure levels up to 10,000 ppm. Propylene is classified as a Group C carcinogen, possibly a human carcinogen.

11929 **(PB—89-120257/XAB) Health and environmental effects profile for ethyl acrylate.** (Environmental Protection Agency, Cincinnati, OH (USA). Office of Environmental Criteria and Assessment). May 1987. 99p. (EPA—600/X-87/162). NTIS, PC A05/MF A01.

The Health and Environmental Effects Profile for ethyl acrylate was prepared to support listings of hazardous constituents of a wide range of waste streams under Section 3001 of the Resource Conservation and Recovery Act (RCRA) and to provide health-related limits for emergency actions under Section 101 of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). Both published literature and information obtained from Agency program office files were evaluated as they pertained to potential human-health, aquatic-life and environmental effects of hazardous-waste constituents. Ethyl acrylate has been evaluated as a carcinogen. The human carcinogen potency factor ($q1^*$) for ethyl acrylate is .048/mg/kg/day for oral exposure. The Reportable Quantity (RQ) value for ethyl acrylate is 1000.

11930 **(PB—89-120323/XAB) Health and environmental effects profile for ethyl acetate.** (Environmental Protection Agency, Cincinnati, OH (USA). Office of Environmental Criteria and Assessment). Dec 1986. 73p. (EPA—600/X-87/028). NTIS, PC A04/MF A01.

The Health and Environmental Effects Profile for ethyl acetate was prepared to support listings of hazardous constituents of a wide range of waste streams under Section 3001 of the Resource Conservation and Recovery Act (RCRA) and to provide health-related limits for emergency actions under Section 101 of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). Both published literature and information obtained from Agency program office files were evaluated as they pertained to potential human-health, aquatic-life and environmental effects of hazardous-waste constituents. Ethyl acetate has been determined to be a systemic toxicant. The daily exposure to the human population (including sensitive subgroups) that is likely to be without appreciable risk of deleterious effect during a lifetime, for ethyl acetate is 0.9 mg/kg/day for oral exposure. The Reportable Quantity (RQ) value for ethyl acetate is 1000.

11931 **(PB—89-120331/XAB) Health and environmental effects profile for Direct Brown 95.** (Environmental Protection Agency, Cincinnati, OH (USA). Office of Environmental Criteria and Assessment). Mar 1987. 58p. (EPA—600/X-87/117). NTIS, PC A04/MF A01.

The Health and Environmental Effects Profile for Direct Brown 95 was prepared to support listings of hazardous constituents of a wide range of waste streams under Section 3001 of the Resource Conservation and Recovery Act (RCRA) and to provide health-related limits for emergency actions under Section 101 of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). Both published literature and information obtained from Agency program office files were evaluated as they pertained to potential human-health, aquatic-life and environmental effects of hazardous-waste constituents. The human carcinogen potency factor ($q1^*$) for Direct Brown 95 is 9.3 (mg/kg/day) for oral exposure. The Reportable Quantity (RQ) value for Direct Brown 95 is 100.

11932 **(PB—89-121230/XAB) Pulmonary disease in workers exposed to papain: clinical, physiological, and immunological studies.** Novey, H.S.; Keenan, W.J.; Fairshter, R.D.; Wells, I.D.; Wilson, A.F. (California Univ., Irvine (USA). Dept. of Community and Environmental Medicine). 1979. 31p. NTIS, PC A03/MF A01.

The pulmonary effects of papain exposure were studied among 23 employees of a company that manufactured a soft-contact-lens cleaning product. Moderate to severe pulmonary symptoms were found in 12 workers. The presence of immunoglobulin-E (IgE) was correlated with decreased lung volumes and expiratory flow rates and total serum. Specific IgE and precipitating antibodies against papain were correlated with symptomatology, pulmonary-function test results, duration and intensity of papain exposure, and atopic history. When 5 of the 12 workers with respiratory symptoms were interviewed 4 to 11 months after job reassignment, all were asymptomatic but abnormal lung function and immunological reaction persisted. The authors concluded that papain acts as an inhalant allergen and is a potent sensitizer in humans. Pulmonary reactions involve inflammation of small airways, alveolar, and interstitial lung tissue, producing symptoms resembling bronchitis and interstitial lung disease. Immunoserological and pulmonary function monitoring is recommended for exposed workers along with the use of personal protective and engineering control measures.

11933 **(PB—89-122964/XAB) Health and environmental-effects profile for alpha-methylstyrene.** (Environmental Protection Agency, Cincinnati, OH (USA). Office of Environmental Criteria and Assessment). Mar 1987. 62p. (EPA—600/X-87/136). NTIS, PC A04/MF A01.

The Health and Environmental Effects Profile for alpha-methylstyrene was prepared to support listings of hazardous constituents of a wide range of waste streams under Section 3001 of the Resource Conservation and Recovery Act (RCRA) and to provide health-related limits for emergency actions under Section 101 of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). Both published literature and information obtained from Agency program office files were evaluated as they pertained to potential human-health, aquatic-life and environmental effects of hazardous-waste constituents. Alpha-methylstyrene has been determined to be a systemic toxicant. A Reference Dose (RfD), defined as an estimate (with uncertainty spanning perhaps an order of magnitude) of the daily exposure to the human population (including sensitive subgroups) that is likely to be without appreciable risk of deleterious effect during a lifetime, for alpha-methylstyrene is 0.069 mg/kg/day for inhalation exposure. The Reportable Quantity (RQ) value for alpha-methylstyrene is 1000.

11934 **(PB—89-122972/XAB) Health and environmental effects profile for 4-chloro-2-methylaniline and 4-chloro-2-methylaniline hydrochloride.** (Environmental Protection Agency, Cincinnati, OH (USA). Office of Environmental Criteria and Assessment). Dec 1986. 73p. (EPA—600/X-87/036). NTIS, PC A04/MF A01.

The Health and Environmental Effects Profile for 4-chloro-2-methylaniline and 4-chloro-2-methylaniline hydrochloride was prepared to support listings of hazardous constituents of a wide range of waste streams under Section 3001 of the Resource Conservation and Recovery Act (RCRA) and to provide health-related limits for emergency actions under Section 101 of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). Both published literature and information obtained from Agency program office files were evaluated as they pertained to potential human-health, aquatic-life and environmental effects of hazardous-waste constituents. The human carcinogen potency factors (q1*) for 4-chloro-2-methylaniline and 4-chloro-2-methylaniline hydrochloride are 0.58 and 0.46/(mg/kg/day), respectively, for oral exposure. The Reportable Quantity (RQ) value for 4-chloro-2-methylaniline and 4-chloro-2-methylaniline hydrochloride is 5000.

11935 **(PB—89-123004/XAB) Health and environmental effects profile for 2,4-dimethylaniline and 2,4-dimethylaniline hydrochloride.** (Environmental Protection Agency, Cincinnati, OH (USA). Office of Environmental Criteria and Assessment). Jan 1987. 70p. (EPA—600/X-87/038). NTIS, PC A04/MF A01.

The Health and Environmental Effects Profile for 2-4-Dimethylaniline and 2,4-Dimethylaniline Hydrochloride was prepared to support listings of hazardous constituents of a wide range of waste streams under Section 3001 of the Resource Conservation and Recovery Act (RCRA) and to provide health-related limits for emergency actions under Section 101 of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). Both published literature and information obtained from Agency program office files were evaluated as they pertained to potential human-health, aquatic-life and environmental effects of hazardous-waste constituents. The human carcinogen potency factors (q1*) for 2-4-dimethylaniline and 2,4-dimethylaniline hydrochloride are 0.75 and 0.58/(mg/kg/day) respectively, for oral exposure. The Reportable Quantity (RQ) value for 2-4-dimethylaniline and 2,4-dimethylaniline Hydrochloride is 1000.

11936 **(PB—89-123012/XAB) Health and environmental effects profile for 2-methoxy-5-nitroaniline.** (Environmental Protection Agency, Cincinnati, OH (USA). Office of Environmental Criteria and Assessment). Jan 1987. 57p. (EPA—600/X-87/039). NTIS, PC A04/MF A01.

The Health and Environmental Effects Profile for 2-Methoxy-5-nitroaniline was prepared to support listings of hazardous constituents of a wide range of waste streams under Section 3001 of the Resource Conservation and Recovery Act (RCRA) and to provide health-related limits for emergency actions under Section 101 of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). Both published literature and information obtained from Agency program office files were evaluated as they pertained to potential human-health, aquatic-life and environmental effects of hazardous-waste constituents. The human carcinogen potency factor (q1*) for 2-methoxy-5-nitroaniline is .0456/(mg/kg/day) for oral exposure. The Reportable Quantity (RQ) value for 2-methoxy-5-nitroaniline is 1000.

11937 **(PB—89-123038/XAB) Health and environmental effects profile for n,n-dimethylaniline.** (Environmental Protection Agency, Cincinnati, OH (USA). Office of Environmental Criteria and Assessment). Nov 1986. 64p. (EPA—600/X-87/052). NTIS, PC A04/MF A01.

The Health and Environmental Effects Profile for N,N-Dimethylaniline was prepared to support listings of hazardous constituents of a wide range of waste streams under Section 3001 of the Resource Conservation and Recovery Act (RCRA) and to provide health-related limits for emergency actions under Section 101 of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). Both published literature and information obtained from Agency program office files were evaluated as they pertained to potential human-health, aquatic-life and environmental effects of hazardous-waste constituents. A Reference Dose (RfD), defined as an estimate (with uncertainty spanning perhaps an order of magnitude) of the daily exposure to the human population (including sensitive subgroups) that is likely to be without appreciable risk of deleterious effect during a lifetime, for N,N-dimethylaniline is 0.002 mg/kg/day for oral exposure. The Reportable Quantity (RQ) value for N,N-dimethylaniline is 100.

11938 **(SNV—3519) Use of the Ames test for investigating the mutagenicity of air pollutants.** Victorin, K. (Institute of Environmental Medicine, Stockholm (SE). Dept. of Toxicology). (National Swedish Environmental Protection Board, Solna). Aug 1988. 74p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88755870/JAW.

Biological short-term tests based on the mutation hypothesis of cancer initiation can be used to detect genotoxic, potentially carcinogenic, environmental pollutants. When comparing similar sources, the relative mutagenic activity of combustion emissions can, with due caution, be used as a rough indicator of carcinogenic risk. In the present investigation the Ames Salmonella bacterial test has been used to characterize different combustion emissions and air pollutants that contribute to the potential carcinogenicity of air pollution. Investigation of the short-term variation in particulate mutagenic emissions from a modern, pulverized-coal fired plant showed that mutagenic emissions varied over a 60-fold range. However, the peak emissions only slightly increased the long-term average emission of mutagenic compounds, which is the most relevant factor concerning cancer risks. Two of four waste incineration plants investigated were shown to emit more mutagenic substances than do plants of similar size that use other fuels. One newly constructed incinerator and one incinerator using refuse-derived fuel had lower emissions than the other two incinerators, which shows that mutagenic emissions can be effectively reduced by technical means. Particulate mutagenic emissions were measured from six gasoline-fueled cars with different systems for exhaust reduction. The regulated emissions (carbon monoxide, hydrocarbons, and nitrogen oxides) were relatively poor indicators of mutagenic activity present in the exhaust. (With 181 refs.)

11939 **Effects of buthionine sulfoximine on the development of ozone-induced pulmonary fibrosis.** Sun, J.D.; Pickrell, J.A.; Harkema, J.R.; McLaughlin, S.I.; Hahn, F.F.; Henderson, R.F. (Lovelace Biomedical and Environmental Research Institute, Albuquerque, NM (USA)). *Experimental and Molecular Pathology;* 49: No. 2, 254-266(Oct 1988).

The capacity of reduced glutathione (GSH) to protect lung tissue against ozone-induced pulmonary fibrosis was investigated. Male B6C3F1 mice were exposed to 0, 0.2, 0.5, and 1.0 ppm ozone for 23 hr/day for 14 days. During exposures and/or for a period of 90 days after exposures, subgroups of mice at each exposure level

were given drinking water containing 30 mM L-buthionine-S,R-sulfoximine (BSO) to lower in vivo levels of GSH. These BSO treatments reduced blood glutamylcysteine synthetase (GCS) activity (regulatory enzyme for GSH biosynthesis) and lung nonprotein sulfhydryl (NPSH) levels in nonexposed animals by approximately half. In contrast, ozone exposures increased blood GCS activity and lung NPSH levels in a concentration-dependent manner, with smaller increases in the BSO-treated mice. Immediately after exposures, an ozone-related inflammatory response was seen in lungs, but no histopathological signs of developing fibrosis were evident. Ninety days later, mice exposed to 1 ppm ozone and not treated with BSO had modest evidence of pulmonary fibrosis. Mice exposed to 1 ppm ozone and treated with BSO during this post-exposure period (regardless of BSO treatment during exposures) showed histopathological evidence of exacerbated pulmonary fibrosis, compared to similarly exposed mice not treated with BSO postexposure. These results indicated that interference with the body's normal defense mechanisms against oxidant damage, including suppression of GSH biosynthesis, exacerbates the subsequent development of pulmonary fibrosis.

5604 Other Environmental Pollutant Effects

11940 **(AD-A—198303/0/XAB) ELF (extremely low frequency) Communication System ecological monitoring program: electromagnetic-field measurements and engineering support - 1987. Technical report, 1982-1987.** Haradem, D.P.; Gauger, J.R.; Zapotosky, J.E. (IIT Research Inst., Chicago, IL (USA)). Aug 1988. 284p. (IITRI-EO—6595-1). NTIS, PC A13/MF A01.

A long-term program for studying possible effects from the operation of the Navy's ELF Communications System is being conducted on biota and ecosystems components in northwestern Wisconsin and the Upper Peninsula of Michigan. Sixteen general types of organisms from three major ecosystems in the ELF system area are being examined. Formulation of an ELF Ecological Monitoring Program was completed in early 1982 by the Department of the Navy, and studies were initiated in late summer of the same year. Beginning in 1983 and continuing during 1984, major activities of the program consisted of characterization of critical aspects of each study, collection of data to validate assumptions made in proposals, and selection of study sites. From 1985 through 1987, activities centered on the operation of full-scale studies. This report documents electromagnetic (EM) field measurements at investigator-selected study sites from 1982 through 1987. Other engineering support activities are also described.

11941 **(AD-A—198875/7/XAB) Microwave irradiation and cold exposure. Final report, 18 July 1984-17 July 1985.** Adair, E.R. (John B. Pierce Foundation of Connecticut, Inc., New Haven (USA)). 17 Aug 1988. 12p. (JBP-ONR—3). NTIS, PC A03/MF A01.

A pilot study investigated the consequences of chronic exposure (40 h/wk) to 2450-MHz CW microwaves, or sham exposure, in a cold (18 C) environment on the thermoregulatory responses, both behavioral and physiological, of squirrel monkeys. Four animals exposed to microwaves at 20 mW/cm^2 exhibited responses that indicated slight amelioration of the mild cold stress while four sham-exposed animals sustained no thermoregulatory deficits. Although the sample size was too small to yield statistically reliable data, general trends in the results support the view that exposure to microwaves of moderate intensity in the work environment is benign in terms of long-term effects on thermoregulatory processes.

11942 **(PB—89-115026/XAB) Effects of aircraft noise and sonic booms on domestic animals and wildlife: a literature synthesis.** Manci, K.M.; Gladwin, D.N.; Villella, R.; Cavendish, M.G. (National Ecology Research Center, Fort Collins, CO (USA)). Jun 1988. 97p. (NERC—88/29). NTIS, PC A05/MF A01.

See also PB—89-115034.

An information base on the effects of aircraft noise and sonic booms on various animal species is necessary to assess potential impacts to wildlife populations from proposed military flight operations. Thus, in a joint U.S. Air Force/U.S. Fish and Wildlife Service effort, the National Ecology Research Center conducted a literature search of information pertaining to animal hearing and the effects of aircraft noise and sonic booms on domestic animals and wildlife. Information concerning other types of noise was also gathered to supplement the lack of knowledge on the effects of aircraft noise. The literature is summarized in the report to provide an overview of current knowledge. No attempt was made to evaluate the appropriateness or adequacy or the scientific approach of each study. A brief overview of the physics of sound and aircraft noise and sonic-boom characteristics also is included to familiarize the reader with the terminology and concepts of aircraft noise and sonic-boom impact analysis.

11943 **(PB—89-115034/XAB) Effects of aircraft noise and sonic booms on domestic animals and wildlife: bibliographic abstracts.** Gladwin, D.N.; Manci, K.M.; Villella, R. (National Ecology Research Center, Fort Collins, CO (USA)). Jun 1988. 84p. (NERC—88/32). NTIS, PC A05/MF A01.

See also PB—89-115026.

The purpose of the document is to provide an information base on the effects of aircraft noise and sonic booms on various animal species. Such information is necessary to assess potential impacts to wildlife populations from proposed military and other flight operations. To develop the document the National Ecology Research Center conducted a literature search of information pertaining to animal hearing and the effects of aircraft noise and sonic booms on domestic animals and wildlife. Information concerning other types of noise was also gathered to supplement the lack of knowledge on the effects of aircraft noise. The bibliographic abstracts in the report provide a compilation of current knowledge. No attempt was made to evaluate the appropriateness or adequacy of the scientific approach of each study. (A literature synthesis is available in a separate document.)

11944 **(PB—89-118640/XAB) Behavioral effects of microwaves: relationship of total dose and dose rate.** O'Connor, M.E.; Strattan, R. (Tulsa Univ., OK (USA)). Oct 1988. 67p. NTIS, PC A04/MF A01.

The goal of the research was to compare the relationship of whole-body averaged specific absorption rate (SAR) and specific absorption (SA) to determine whether dose rate or dose was the better predictor of biological effects. Sperm-positive Long-Evans female rats were exposed to 2450-MHz CW microwave radiation for 1-3 hours at approximately 10 W/kg. The maternal subjects were then observed for natural delivery of their litters. Sensitivity to thermally induced seizures and huddling were studied in the offspring. Analyses revealed that there were no statistically significant differences between exposed and control offspring on the behavioral indices. The behavior did not appear to be affected by prenatal exposure to microwave radiation at this level. The huddle sizes became smaller as the pups aged both in exposed and control offspring.

11945 **(PB—89-120448/XAB) Walk-through survey report on industrial hygiene and epidemiologic evaluation of potential cohort exposed to radiofrequency radiation from dielectric heat sealers, Travenol Laboratories, Inc., North Cove, North Carolina, January 27, 1982.** Cox, C.; Leet, T.; Murray, B.; Johnson, P. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA)). 24 Jun 1982. 37p. (IWS—088.39). NTIS, PC A03/MF A01.

A walk-through survey was conducted at Travenol Laboratories, Inc., North Cove, North Carolina where polyvinyl-chloride intravenous bag sets were manufactured. Dielectric radiofrequency (RF) heat sealers were used during the manufacturing process. The only appreciable exposure to employees involved in the heat sealing operation appeared to be RF waves. Examination of the 19 heat sealers used indicated that two of the machines generated incident radiation of 0.65 and 2.85 amperes squared/meter squared (A^2/m^2) which are both above the current OSHA standard of 0.25 A^2/m^2. Magnetic fields generated by the other heat sealers ranged from nondetectable to 0.171 A^2/m^2 and the electric fields ranged from nondetectable to 20,800 volts squared/meter squared (V^2/m^2) with an average of 4110 V^2/m^2. Records kept at the firm were sufficiently detailed and accurate to permit an epidemiological survey, but almost all exposures were less than 10% of the current allowable

standards. The authors concluded that this specific facility should not be included in the overall study cohort to review the effect of exposures to RF radiation on heat-sealer operators.

11946 **(PB—89-120620/XAB) Health-hazard evaluation report HETA 86-051-1911, National Cover of Atlanta, Inc., Lawrenceville, Georgia.** Fidler, A.T.; Crandall, M.S.; Kerndt, P.R. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA)). Jun 1988. 46p. (HETA—86-051-1911). NTIS, PC A03/MF A01.

In response to a request from an employee at National Cover of Atlanta, Inc., Lawrenceville, Georgia, an evaluation was made of possible hazardous working conditions. High-quality three-ring binders and other packaging materials were produced by this company. Plastic covers were sealed by radiofrequency heat sealers around a cardboard insert. The possibility of an increased number of spontaneous abortions among women employees were investigated. There were 225 pregnancies in the 148 women in the study; 158 occurred among women not working outside the home, 52 occurred to women employed outside the home but not at National Cover, and 15 occurred among women employed at National Cover. THe adverse outcome rate was 53% for women working elsewhere. All measurements of electrical and magnetic fields near the heat sealing machines were below the OSHA standards. Exposure to solvent vapors was up to 80% of the threshold limit value for solvent mixtures. The authors recommend product substitution to less-toxic organic solvents and inks, and the installation of an industrial ventilation system. The manufacturer of the radiofrequency heat-sealing equipment should be contracted to provide a properly designed shield for these machines.

11947 **(PB—89-120646/XAB) Health-hazard evaluation report HETA 87-329-1898, Fermilab, Batavia, Illinois.** Moss, C.E.; Boiano, J.M. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA)). May 1988. 22p. (HETA—87-329-1898). NTIS, PC A03/MF A01.

In response to a request from the Fermi National Accelerator Laboratory, Batavia, Illinois, assistance was given to determine the degree of employee exposure to radiofrequency (RF) radiation from the particle-accelerator systems. High-power RF amplifiers are used to accelerate protons and antiprotons to extremely high energies. Research is conducted at the lab in the area of high-energy physics. Monitoring was carried out for static magnetic and radiofrequency fields in the Linac, Booster, and Main Ring areas. Static magnetic field levels were quite low, except for the levels measured near the Bubble Chamber. RF radiation did not exceed the American National Standard Institute standards for electric and magnetic fields. The authors concluded that RF exposures at Fermi did not constitute a hazard to workers at the time of the evaluation. The authors recommend that the static magnetic fields should be monitored and documented for possible future analysis. Field-monitoring instruments should be obtained. The sources of potential water leaks should be eliminated within the booster area. Flammable material should be removed from electronic cabinets.

57 HEALTH AND SAFETY

11948 **(BNL—42062) Hazard characterization and management of tetramethyl tin in the production of photovoltaic cell transparent conductive oxide layers.** Kalb, P.D.; Moskowitz, P.D. (Brookhaven National Lab., Upton, NY (USA)). 1988. Contract AC02-76CH00016. 6p. (CONF-880965—25). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004522/JAW.

From 20. IEEE photovoltaic specialists conference; Las Vegas, NV, USA (26 Sep 1988).

Tetramethyl tin (TMT) has been used by the photovoltaics industry to prepare transparent conductive oxide films on glass. Significant health hazards, however may be associated with the use of TMT. Short-term exposures to TMT vapors in excess of accepted exposure limits can produce a range of physiological symptoms. Although less is known about the hazards from prolonged exposure to low levels of TMT, some studies suggest that effects are both cumulative and persistent. TMT also is highly flammable and emits toxic fumes on decomposition. In an occupational setting, workers may be routinely or accidentally exposed to TMT liquids or vapors. Approaches for controlling these occupational hazards are described. Analysis suggests that routine emissions from large scale manufacturing facilities using TMT will need to be reduced by approximately 90% to comply with toxic gas containment guidelines to protect public health. Thermal afterburners combined with particle filtration may be used to meet these guidelines. Accidental release of the total inventory of TMT at a large-scale plant may present hazards to individuals living about 1 km from the facility's boundary. Because of these hazards, strategies to prevent in-plant release coupled with community emergency response programs are needed. 32 refs., 2 figs., 4 tabs.

11949 **(DOE/EH—0079-Vol.1) Environment, safety, and health needs of The US Department of Energy: Volume 1: Assessment of needs.** (USDOE, Washington, DC). Dec 1988. 40p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004765/JAW.

This report identifies the activities and estimates the associated resources needed for Department of Energy (DOE) facilities and operations to achieve and maintain compliance with current environmental, safety, and health requirements and standards. This assessment of activity and resource needs is based on data submitted by individual DOE field and program offices. This is not a planning document, and detailed analyses of the needs, along with prioritization, validation, funding, and program planning, are outside the scope of this report. 12 figs., 1 tab.

11950 **(EGG-BNCT—7926) PBF/BNCT Program for cancer treatment: Monthly bulletin: Volume 2, No. 9.** Dorn, R.V. III. (EG and G Idaho, Inc., Idaho Falls (USA)). Sep 1988. Contract AC07-76ID01570. 77p. NTIS, PC A05/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004946/JAW.

This month's bulletin summarizes the considerable ongoing progress within the various project arms of the PBF/BNCT Program. Continued progress toward institution of the experimental program at BMRR is represented by further calculations modeling the BMRR filter design and predicted output, as well as initial diagnostic workup of the dogs to be used in initiating these studies. A draft for the canine dosimetry measurement plan in support of this is under review. Work with the canine-model system continues with ongoing plasmapheresis experiments and institution of in-vivo sampling of liver tissue for shipping to Cornell for secondary ion microscopy (SIM) studies. The SIM work at Cornell has also expanded in a cooperative fashion with the University of Rochester, looking at human lung tumor cells and spheroids. Activity in the supporting technology projects includes decreased backlog of Inductively Coupled Plasma-Atomic Emission Spectroscopy (ICP-AES) analysis, detailed investigation of competing digestion procedures of tissue samples for ICP-AES, and further refinement of QA/QC analytical methodologies. Progress in the development of hardware tools continues with respect to MRI system modification and with expected delivery shortly of the Apollo workstation for use in radiation dosimetry and treatment-planning programs (with potential software collaboration with the University of Utah).

11951 **(UCRL—97868) An educational approach to an epidemic of repetitive motion injuries among office workers.** Halunen, L.J. (Lawrence Livermore National Lab., CA (USA)). 23 Sep 1988. Contract W-7405-ENG-48. 10p. (CONF-8811121—1). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89003894/JAW.

From 3. international conference on musculoskeletal accidents and injuries in the workplace; Bangkok, Thailand (7 Nov 1988).

Among office workers, repetitive motion injuries such as tendonitis, muscle fatigue, and nerve irritation (caused by poor posture and arm/hand positioning while performing repetitive tasks) are a fairly new phenomenon. Office workers and their managers are not prepared to respond properly to the identification and treatment of these injuries. We found an unusually high incidence within one department at a large research facility--the Lawrence Livermore National Laboratory--and developed an educational approach to reduce the frequency and severity of these injuries. Our approach was to inform the workers and managers about the origins and severity of repetitive motion injuries and their effect on

the work force. Classes in ergonomic adjustment of video workstations were scheduled for all personnel who had jobs that required heavy keyboard use. The individual's responsibility in reporting any symptoms of repetitive motion injury was emphasized. We stressed to management the seriousness of the problem, the desirability of obtaining improved equipment workers may need, or the possibility of arranging a lighter workload for those showing symptoms of repetitive motion injuries. We followed these classes and briefings with additional videotaped material and written guidelines, pamphlets, and articles for further study and discussion. Early results indicate that informed workers in a supportive environment detect symptoms earlier, and therefore recover more quickly; managers who understand the problem and are able to respond positively gain better labor relations as well as lower injury rates. 4 refs., 2 figs.

58 GEOSCIENCES

5801 Geology And Hydrology

REFER ALSO TO CITATION(S) 10662, 10873, 10874, 10875, 10876, 10877, 10940

11952 **(DOE/BC/14126—1) An analytical study of transient behavior of nonhomogeneous linear and radial systems: Supri TR 60.** Ambasthe, A.K.; Ramey, H.J. Jr. (Stanford Univ., CA (USA). Petroleum Research Inst.). Nov 1988. Contract FG19-87BC14126. 77p. (SUPRI-TR—60). NTIS, PC A05/MF A01 - OSTI; 1; GPO Dep. Order Number DE88001245/JAW.

This study presents new analytical solutions for the dimensionless pressure drop or cumulative influx for nonhomogeneous aquifers whose thickness, permeability-viscosity ratio, or porosity-compressibility vary linearly with distance. These solutions apply to linear flow conditions with finite aquifer size. The inner boundary condition may be either constant rate or constant pressure. The outer boundary may be either closed, or at constant pressure. Based on this study, a nonhomogeneous aquifer behaves as a homogeneous aquifer at early times. At late times, pseudosteady, exponential depletion, or steady state behavior is observed, depending on the outer boundary condition. But the dimensionless time to late time state is dependent on the type and severity of the property variation. Limiting solutions at early and late times are presented for each case. Attempts to obtain analytical solutions for radial nonhomogeneous systems with properties varying linearly with radial distance were unsuccessful. However, a discussion of techniques considered appears in this study. The reasons why the techniques failed may be helpful in future attempts to solve the problem. 17 refs., 16 figs., 10 tabs.

5802 Geophysics

11953 **(DOE/CE/15305—T2) Design and construction of a prototype in situ geotechnical testing system: Final progress report.** (Dynamic In Situ Geotechnology Testing, Lutherville, MD (USA)). 20 Nov 1988. Contract FG01-87CE15305. 5p. NTIS, PC A02/MF A01 - OSTI. Order Number DE89004671/JAW.

This progress report documents significant accomplishments related to the completion of the subject project. Current activities, difficulties which have been encountered and solutions to these difficulties are discussed and a near-term outlook is provided. The goal of the subject project is to construct a laboratory prototype of a proposed in situ geotechnical testing system for determining cyclic and dynamic properties of soil deposits. Such properties are often needed for the earthquake resistant design of critical energy-related facilities (offshore oil production platforms and islands, power plants, dams, etc.). 5 figs.

11954 **(LA—11441-T) Field and theoretical aspects of explosive volcanic transport processes.** Valentine, G.A. (Los Alamos National Lab., NM (USA)). Dec 1988. Contract W-7405-ENG-36. 216p. NTIS, PC A11/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005294/JAW.

Chapter 1 presents results of a study of deposits at the base of the large-volume Peach Springs Tuff ignimbrite (referred to as layer 1). The layer 1 deposits are interpreted to record initial blasting and pyroclastic surge events at the beginning of the eruption. Changes in bedding structures with increasing flow distance are related to the decreasing sediment load of the surges and possibly to shocks in the surges. In Chapter 2 stratified glow theory is applied to pyroclastic surges. Particle transport is assumed to be turbulent suspension. The discussion centers on the Rouse, Froude, and Richardson numbers, and the Brunt-Vaisala frequency. Chapter 3 presents results of simulations Plinian eruption columns based upon numerical solution of the time-dependent, two-phase, compressible Navier-Stokes equations. Consideration of dimensionless groups define conditions leading to column collapse. Collapsing fountains form pyroclastic flows that consist of low-concentration fronts, relatively thick heads, vortex development along the top surfaces, and rising clouds of buoyant ash. The presence of coarse-grained proximal deposits primarily reflects tephra sorting within the eruption column before collapse. 154 refs., 32 figs., 2 tabs.

11955 **(LBL—26121) A new semi-analytical method for numerical simulation of fluid and heat flow in fractured reservoirs.** Pruess, K.; Wu, Y.S. (Lawrence Berkeley Lab., CA (USA)). Oct 1988. Contract AC03-76SF00098. 33p. (CONF-890234—1). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89002958/JAW.

From 10. Society of Petroleum Engineers symposium on reservoir simulation; Houston, TX, USA (6 Feb 1989).

Permeability and flow in many petroleum, gas, and geothermal reservoirs are dominated by fractures. Despite major advances in recent years, mathematical modeling of fluid and heat flow in fractured reservoirs remains a difficult problem. Porous medium approximations have been shown to be inadequate for many flow processes in fractured systems, while double- or multiple-porosity techniques may involve excessive amounts of numerical work or large discretization errors. We have developed a new method for modeling fluid and heat flow in fractured reservoirs which is an extension of a technique developed by Vinsome and Westerveld, for calculating heat exchange between permeable layers and impermeable semi-infinite confining beds during thermally enhanced oil recovery. Our method combines a finite-difference description of global flow in the fractures with an analytical representation of interporosity flow by means of trial functions for fluid pressures and temperatures in the matrix blocks. The trial functions contain adjustable parameters which are calculated for each time step in a fully coupled way based on matrix block shapes and dimensions, utilizing simple mass and energy conservation principles. We have incorporated the semi-analytical technique into our general-purpose multiphase simulator MULKOM. The method was verified by comparison with exact analytical solutions for fluid and heat exchange with individual matrix blocks. Applications were made to geothermal well test and production-injection problems with interporosity fluid and heat flow. The calculations show excellent agreement with numerical simulations using the method of "multiple interacting continua" (MINC), with no noticeable increase in computing work compared to porous medium calculations. 36 refs., 10 figs., 7 tabs.

11956 **(PB—89-121867/XAB) World Data Center a for Solid Earth Geophysics, Directory of Data Sources for Lithospheric Investigations. Volume 1.** Meyers, H.; Shebalin, P. (World Data Center A for Solid Earth Geophysics, Boulder, CO (USA)). Aug 1988. 401p. (SE—44). NTIS, PC A18/MF A01.

See also PB—84-101161. Also pub. as International Lithosphere Program rept. no. PUB-156.

Directory of Data Sources for Lithospheric Investigations, Volume I, presents information to the scientific community on data holdings and data availability all over the world. Each entry includes the title of the institution or data center, a very general description of existing data, person to contact, geographic area covered by the data, and availability of information. Data output is also listed (for example, publications, magnetic tapes, microfilms, microfiche, listings, CD-ROMs, PC diskettes, maps, etc.). The publication is a convenient tool to simplify first contacts with institutions. Volume I includes information about geophysical data repositories

for the following fields: earthquake seismology, exploration and deep seismic sounding, gravity, magnetics, paleomagnetism, recent crustal movements, volcanoes, geothermics, and deep drilling. Volume II, in preparation, will describe repositories of geological data.

11957 **Plume formation and lithosphere erosion: A comparison of laboratory and numerical experiments.** Olson, P.; Schubert, G.; Anderson, C.; Goldman, P. (Department of Earth and Planetary Sciences, The Johns Hopkins University Baltimore, Maryland). *Journal of Geophysical Research;* 93: No. B12, 15065-15084(10 Dec 1988).

The mechanics of thermal plume formation and intrusion into the lithosphere are investigated using a combination of laboratory experiments and numerical simulations. In the experiments a deep layer of strongly temperature-dependent viscous sucrose solution is heated from below and cooled from above to produce high-viscosity surface and low-viscosity basal thermal boundary layers. Plumes develop from instabilities in the hot boundary layer, ascend, and partially intrude into the cold layer (lid). A set of two-dimensional finite element calculations are made using the experimental geometry, fluid properties, and boundary and initial conditions. Satisfactory agreement is obtained for the number and shape of plumes and the time variation of surface heat flux, basal temperature, and, to a lesser extent, lid thickness. The major discrepancy is the onset time for instability, which is typically 30% late in the calculations. Numerical simulations of mantle plume-lithosphere interaction with subsolidus creep rheology show that thermal plumes do not effectively intrude and erode the lithosphere if upper mantle viscosity is a function of temperature only, unless the activation energy is anomalously low, 50 kJ mol/sup -1/ or less. However, plumes can significantly erode the lithosphere on time scales of 10—20 m.y. if a low-viscosity asthenospheric channel, due to pressure dependence of viscosity, is present. copyright American Geophysical Union 1988

5803 Mineralogy, Petrology, And Rock Mechanics

REFER ALSO TO CITATION(S) 10794

5805 Oceanography

11958 **(DOE/ER/60337—4) [Role of bacteria in organic matter fluxes in the southern California coastal zone]: Progress report, November 15, 1987--November 14, 1988.** Azam, F.; Carlucci, A.F. (California Univ., San Diego, La Jolla (USA). Inst. of Marine Resources). Nov 1988. Contract FG05-85ER60337. 4p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005043/JAW.

This project is the microbiological component of the DOE-sponsored interdisciplinary program entitled "Program of Mineralization and Cycling in Marine Systems"-California Bight Study (CaBS). The main goal of our research is the study of the role of bacteria in influencing the distribution, decomposition, and vertical flux of materials in the coastal ocean. We have been studying: (1) whether bacteria play a significant role in the decomposition of the organic particles sinking into the ocean's interior; (2) how important are bacteria in assimilating dissolved organic matter (DOM) into the particulate phase (particulate organic matter; POM); (3) by what biochemical strategies do bacteria solubilize the particulate organic matter, both in the upper mixed layer and in the ocean's interior; and (4) whether bacterial activity in the upper mixed layer influences the variability of new production. Our research has included field measurements and method development, as well as mechanistic studies using laboratory model systems.

11959 **(DOE/ER/60337—5) Role of bacteria in organic matter fluxes in the southern California coastal zone: [Progress report], May 15, 1985--May 14, 1989.** Azam, F.; Carlucci, A.F. (California Univ., San Diego, La Jolla (USA). Inst. of Marine Resources). 1989. Contract FG05-85ER60337. 7p. NTIS, PC A02/MF A01 - OSTI. Order Number DE89005044/JAW.

This project is the microbiological component of the DOE-sponsored interdisciplinary program entitled "Program of Mineralization and Cycling in Marine Systems"---California Bight Study (CaBS). The main goal of our research is the study of the role of bacteria in influencing the distribution, decomposition, and vertical flux of materials in the coastal ocean. We have been studying: (1) whether bacteria play a significant role in the decomposition of the organic particles sinking into the ocean's interior; (2) how important are bacteria in assimilating dissolved organic matter (DOM) into the particulate phase (particulate organic matter; POM); (3) by what biochemical strategies do bacteria solubilize the particulate organic matter, both in the upper mixed layer and in the ocean's interior; and (4) whether bacterial activity in the upper mixed layer influences the variability of new production. Our research has included field measurements, method development, as well as mechanistic studies using laboratory model systems. 17 refs.

11960 **(DOE/ER/60338—6) Program of mineralization and cycling in marine systems: Organic geochemistry of particulates and sediments (CaBS): Comprehensive report, November 1985--November 1988.** Venkatesan, M.I.; Kaplan, I.R. (California Univ., Los Angeles (USA). Inst. of Geophysics and Planetary Physics). Nov 1988. Contract FG05-85ER60338. 58p. NTIS, PC A04/MF A01 - OSTI. Order Number DE89005046/JAW.

The major objective of the present on-going project was to understand the processes involved in the cycling of organic carbon in the southern California Bight. This involves the evaluation of the relative flux of planktonic carbon to the seafloor versus the import of terrestrial carbon components and the determination of the rate of decompositions of sedimenting organic matter in the waste column. These goals were achieved by the chemical characterization of sedimenting particles (from traps) as well as in the near surface sediments. At UCLA we have been focusing on the chemical characterization of selected classes of organic carbon compounds derived from different sources to understand the vertical flux and the chemical composition of the particulate organic matter which are controlled by complex transport, transformations, degradation and remineralization. 25 refs., 22 figs., 12 tabs.

11961 **(DOE/ER/60339—5) Compositional and isotopic studies of organic matter in the Santa Monica basin: Progress report, November 14, 1987--November 15, 1988.** Williams, P.M. (California Univ., San Diego, La Jolla (USA). Inst. of Marine Resources). Nov 1988. Contract FG05-85ER60339. 5p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005040/JAW.

Compositional and isotopic studies of organic matter in the Santa Monica basin include particle trap deployments, carbon-14 dating, stable isotopes ($\delta^{13}C$, $\delta^{15}N$); and soluble organic matter fluxes at the sediment/seawater interface.

11962 **(DOE/ER/60348—10) FLEX [Fall Low salinity EXperiment] Hydrographic Data Report: R/V Iselin station profiles, maps, sections, SAIL, and beach data, October--November 1987.** Chandler, W.S.; Atkinson, L.P.; Kim, Cheolsoo. (Old Dominion Univ., Norfolk, VA (USA). Research Foundation). Dec 1988. Contract FG05-85ER60348. 180p. NTIS, PC A09/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005017/JAW.

The FLEX Hydrographic Data Report includes CTD data listings and profile plots of each station taken aboard the R/V Columbus Iselin. In this report are vertical section contours, surface maps of temperature, salinity and sigma-t and a description of the conditions observed on each section. Shipboard Serial Ascii Instrumentation Loop (SAIL) data and data from two beach stations are also presented. FLEX (Fall Low salinity EXperiment) was designed to study the processes affecting the transport and fate of low salinity water in the coastal boundry zone (CBZ) off Georgia and South Carolina during the fall. Averaged historic data (Atkinson et al., 1983) indicated that a band of low salinity water is advected southward along the Florida coast during the fall. The FLEX field program included an array of moored current meters with temperature, conductivity and pressure sensors, and two research vessels (R/V Columbus Iselin and R/V Blue Fin) that conducted hydrographic mapping and biological and chemical sampling. The plan was for the Iselin to survey the study area once as quickly as possi-

ble at the beginning of the cruise. Four sections, at Cape Canaveral, St. Augustine, Brunswick and Savannah, were established with stations 5 and 10 kilometers apart (nearshore and offshore, respectively). On subsequent surveys of the study area saw-toothed mapping with the ship's SAIL system was conducted along the CBZ while transitting between sections. The Iselin mapped the study area five times during the experiment.

11963 **(DOE/ER/60376—4) Shelf export of particulates/ transport in continental margin waters: Progress report, September 15, 1985--September 15, 1988.** Pietrafesa, L.J. (North Carolina State Univ., Raleigh (USA)). Dec 1988. Contract FG09-85ER60376. 140p. NTIS, PC A07 - OSTI. Order Number DE89005556/JAW.

During the present funding period, research activities at NCSU have been directed towards: publishing the results of SEEP-I; publishing further results from NCSU's South Atlantic Bight studies; designing and constructing four cages which house the 3 NCSU and 1 BNL RD- Acoustic Doppler Current Profilers used successfully in SEEP-II, calibrating all current meters, transmissometers, thermister chains and conductivity pressure and temperature sensors for SEEP-II Phases 1, 2, and 3 (cf. Table 3); determining the temporal and spatial scales of physical processes observed during Phases 1 and 2 of SEEP-II in preparation for finalizing the mooring positions and sampling intervals for SEEP-II, Phase 3; shipping all NCSU gear to the RV Endeavor at the University of Rhode Island and the Navy's Little Creek, Virginia Amphibious Base; and successful deployment of NCSU SEEP-II, Phases 1,2 and 3 moorings.

11964 **(DOE/ER/60555—1) [Transport and transfer rates in the waters of the continental shelf and slope: SEEP]: Annual report, 1 May 1988--30 April 1989.** (Columbia Univ., Palisades, NY (USA). Lamont-Doherty Geological Observatory). 1989. Contract FG02-87ER60555. 38p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005387/JAW.

The second year of the current three-year grant has been devoted in great degree to the field experiment phase of the SEEP-II project, and, during periods not involving our personnel in the field, to continuation and completion of analyses and publication of SEEP-I samples and results. This report is organized to reflect those emphases: 1.0 SEEP-II; 2.0 SEEP-I; 3.0 Other Accomplishments; and 4.0 COMFS Planning and National and International SEEP-Related Activities. 7 refs., 6 figs., 5 tabs.

11965 **(DOE/ER/60628—2) [Utilization, cycling, and vertical transport of particulate organic matter in the marine coastal environment]: [Progress report], November 1985--November 1988.** Landry, M.R.; Lorenzen, C.J. (Washington Univ., Seattle (USA); Hawaii Univ., Honolulu (USA). Hawaii Inst. of Geophysics). 1988. Contract FG05-88ER60628;FG05-85ER60335. 11p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005145/ JAW.

The three years of study covered in this report were conducted as a component of the CaBS (California Basin Study) Program which investigates the production, cycling, transport, and fate of organic matter, chemical tracers, and pollutants in the Southern California Coastal margin off Los Angeles. Progress during this phase of the Program, particularly with regard to integrating water column and sediment work, was facilitated by focusing on the Santa Monica Basin, a deep, near-shore depression with restricted inputs and outputs. 33 refs., 3 figs., 8 tabs.

64 PHYSICS I

6401 Astrophysics And Cosmology

REFER ALSO TO CITATION(S) 11498

11966 **(DOE/ER/40423—01-C8) Cosmological perturbations from quantum fluctuations to large scale structure.** Bardeen, J.M. (Washington Univ., Seattle (USA). Dept. of Physics). 1988. Contract AS06-88ER40423. 34p. (CONF-8807143—1). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004574/JAW.

From 2. Guo Shou-jing summer school on particle physics and cosomology; Nanjing, China (1 Jul 1988).

Classical perturbation theory is developed from the 3 + 1 form of the Einstein equations. A somewhat unusual form of the perturbation equations in the synchronous gauge is recommended for carrying out computations, but interpretation is based on certain hypersurface-invariant combinations of the variables. The formalism is used to analyze the origin of density perturbations from quantum fluctuations during inflation, with particular emphasis on dealing with 'double inflation' and deviations from the Zel'dovich spectrum. The evolution of the density perturbation to the present gives the final density perturbation power spectrum, whose relationship to observed large scale structure is discussed in the context of simple cold-dark-matter biasing schemes. 86 refs.

11967 (ESA-SP—281-VOL-1, pp 3-7) **Observing SN 1987A with IUE.** Kirshner, R.P. Jun 1988. NTIS, PC A19/ MF A01; ESA Publications Div., ESTEC, Noordwijk, Netherlands, 140 Dutch guilders. (ETN—88-93155; CONF-8804199—).

From A decade of UV astronomy with the IUE satellite; Greenbelt, MD, USA (1 Apr 1988).

Spectra from IUE were used to study SN 1987A in order to examine its progenitor and stellar evolution before the explosion. The B3 Ia blue supergiant is identified as progenitor. The narrow UV lines from the circumstellar shell are discussed. When the supernova turns transparent in the ultraviolet, the ultraviolet spectra can provide important chemical information about the interior of the massive star.

11968 (ESA-SP—281-VOL-1, pp 29-40) **IUE observations of pulsating stars: atmospheric structure, shock waves and stellar winds.** Willson, L.A. Jun 1988. NTIS, PC A19/ MF A01; ESA Publications Div., ESTEC, Noordwijk, Netherlands, 140 Dutch guilders. (ETN—88-93155; CONF-8804199—).

From A decade of UV astronomy with the IUE satellite; Greenbelt, MD, USA (1 Apr 1988).

Pulsating stars studied by IUE, including Miras and semiregular long period variables, Cepheids, RR Lyrae stars, delta Scuti stars, Beta Cep stars, Be stars, hot subdwarfs (PG1159 stars), and pulsating white dwarfs are discussed. The interpretation of IUE observations of obviously pulsating stars in terms of static model atmospheres, models applicable to similar but nonpulsating stars, or models applicable to stars with different pulsation properties is always fundamentally wrong. The atmospheric temperature, density, and velocity structure of a star is very much altered by the presence of radial (or large amplitude nonradial) pulsation, and the structure depends strongly on the pulsation period and on the efficiency of mechanisms driving a stellar wind. For the well-studied radially pulsating stars (Beta Cep variables, Cepheids of all types, and long period variables) IUE observations are all at least qualitatively consistent with the predictions of models and analytic theory based on the assumption that pulsation is the dominant factor.

11969 (ESA-SP—281-VOL-1, pp 47-58) **Comets.** Ahearn, M.F. Jun 1988. NTIS, PC A19/MF A01; ESA Publications Div., ESTEC, Noordwijk, Netherlands, 140 Dutch guilders. (ETN—88-93155; CONF-8804199—).

From A decade of UV astronomy with the IUE satellite; Greenbelt, MD, USA (1 Apr 1988).

The IUE was used to study comets including the first dynamically new comet to approach closer than 3 AU. Differences between old and new comets are studied. Results relevant to the nature of cometary nuclei are discussed. Identification of species in the spectra; relative abundances; variability of comets; and comet mass are considered.

11970 (ESA-SP—281-VOL-1, pp 59-65) **Some recent results from the study of cool stars.** Dupree, A.K. Jun 1988. NTIS, PC A19/MF A01; ESA Publications Div., ESTEC, Noordwijk, Netherlands, 140 Dutch guilders. (ETN—88-93155; CONF-8804199—).

From A decade of UV astronomy with the IUE satellite; Greenbelt, MD, USA (1 Apr 1988).

The IUE observations of circumstellar disks around low mass stars; extended atmospheric structures on cool dwarf stars; pulsation as a common phenomenon in luminous cool stars; and magnetic activity cycles in dwarf stars are reviewed. The results illustrate the unique and scientifically rewarding use of IUE, and the pressing need for multifrequency measurements and continuous measurements of cool stars in order to explore stellar evolution and atmospheric structure.

11971 (ESA-SP—281-VOL-1, pp 67-76) **IUE observations and physical processes of interacting binary stars.** Shore, S.N. Jun 1988. NTIS, PC A19/MF A01; ESA Publications Div., ESTEC, Noordwijk, Netherlands, 140 Dutch guilders. (ETN—88-93155; CONF-8804199—).

From A decade of UV astronomy with the IUE satellite; Greenbelt, MD, USA (1 Apr 1988).

The IUE was used to study processes connected with accretion disk structure and stability, wind accretion and wind-wind collisions, contact systems, and stellar activity in close binary stars. Time dependent phenomena already known from optical studies appear to be even more important in the ultraviolet. The systems show flows which are unstable on timescales of single orbits, variable winds, tidally-induced phenomena, and unstable stellar components. Given that many of the physical processes in interacting binary systems may be nonlinear and highly dependent on the specific details of individual systems, and even on specific times of observation, the reliability of single object analyses and short timescale studies is called into question. Conservative models for mass transfer between components, steady or otherwise, are wrong and need to be corrected in order to properly understand binary star evolution.

11972 (ESA-SP—281-VOL-1, pp 79-83) **Io: IUE observations of its atmosphere and the plasma torus.** Ballester, G.E.; Moos, H.W.; Feldman, P.D.; Strobel, D.F.; Skinner, T.E.; Bertaux, J.L.; Festou, M.C. (Observatoire de Besancon (France)). Jun 1988. NTIS, PC A19/MF A01; ESA Publications Div., ESTEC, Noordwijk, Netherlands, 140 Dutch guilders. (ETN—88-93155; CONF-8804199—).

From A decade of UV astronomy with the IUE satellite; Greenbelt, MD, USA (1 Apr 1988).

Two of the main components of the atmosphere of Io, neutral oxygen and sulfur, were detected with the IUE. Four observations yield brightnesses that are similar, regardless of whether the upstream or the downstream sides of the torus plasma flow around Io is observed. A simple model requires the emissions to be produced by the interaction of O and S columns in the exospheric range with 2 eV electrons. Cooling of the 5 eV torus electrons is required prior to their interaction with the atmosphere of Io. Inconsistencies in the characteristics of the spectra that cannot be accounted for in this model require further analysis with improved atomic data. The Io plasma torus was monitored with the IUE. The long-term stability of the warm torus is established. The observed brightnesses were analyzed using a model of the torus, and variations of less than 30 percent in the composition are observed, the quantitative results being model dependent.

11973 (ESA-SP—281-VOL-1, pp 85-88) **Abundance of micron-sized particles in Saturn's A and B rings.** Wagener, R.; Caldwell, J. (York Univ., Ontario (Canada)). Jun 1988. NTIS, PC A19/MF A01; ESA Publications Div., ESTEC, Noordwijk, Netherlands, 140 Dutch guilders. (ETN—88-93155; CONF-8804199—).

From A decade of UV astronomy with the IUE satellite; Greenbelt, MD, USA (1 Apr 1988).

A set of 12 IUE spectra of Saturn's rings was obtained between July 1982 and Feb. 1985. The large aperture was positioned on the Cassini division at the western ansa and the size of the aperture was such that the A and B rings contributed equally to the total area inside the aperture. The IUE data are complemented at wavelength below 1600 A by Voyager 2 UVS data. The most obvious feature of the combined spectrum, which covers the wavelength range from 500 to 3000 A, is the water ice absorption edge between 1650 and 1700 A. Three different modeling approaches were used to interpret the data: multiple Rayleigh scattering approximation for extremely small particles (r = 0.003 microns); single Mie scattering for power law size distributions (r = 0.01 to 40 microns); and Hapke geometrical optics approximation for very large ring particles (r larger than 100 microns). The most satisfactory fits can be obtained with the Mie scattering approach and the Hapke approximation. However, the available data are not sufficient to uniquely determine a particle size distribution.

11974 (ESA-SP—281-VOL-1, pp 89-92) **Jovian equatorial H2 emission from 1979-1987.** Mcgrath, M.A.; Moos, H.W.; Ballester, G.E.; Coplin, K.A. Jun 1988. NTIS, PC A19/MF A01; ESA Publications Div., ESTEC, Noordwijk, Netherlands, 140 Dutch guilders. (ETN—88-93155; CONF-8804199—).

From A decade of UV astronomy with the IUE satellite; Greenbelt, MD, USA (1 Apr 1988).

Ninety two IUE observations of the Jovian equatorial region taken between 2 Dec. 1978 and 1 Feb. 1988 were averaged together by date of observation, resulting in 22 averaged spectra which were fit with a model to determine the amount of H2 Lyman band emission in the region 1552 to 1624A. The data suggest that the H2 emission may vary with time. Especially suggestive is the marked downward trend of the emission between 1983 and 1987, during which time the strength of the emission in the 1552 to 1624A region decreases by a factor of 10. Uncertainty in the existing data and a gap in the data in 1980 and 1981 preclude a positive identification of a correlation between the brightness of the H2 emission and the major solar cycle.

11975 (ESA-SP—281-VOL-1, pp 93-96) **Large time scale variation in hydrogen emission from Jupiter and Saturn.** Shemansky, D.E.; Hall, D.T.; Holberg, J.B. Jun 1988. NTIS, PC A19/MF A01; ESA Publications Div., ESTEC, Noordwijk, Netherlands, 140 Dutch guilders. (ETN—88-93155; CONF-8804199—).

From A decade of UV astronomy with the IUE satellite; Greenbelt, MD, USA (1 Apr 1988).

The IUE and Voyager spacecraft observations of Jupiter and Saturn were combined to obtain a consistent measurement of temporal variation of the equatorial subsolar hydrogen emission. The outer planets appear to have rather independent behavior over time scales of the order of 10 yr, particularly in emission from the H Ly alpha line. The time interval from 1978 to the present shows variation of mean equatorial H Ly alpha brightness of 2 at Jupiter and 5 at Saturn. The relative magnitudes of the variations is sufficiently different to suggest that response to input from the Sun is at least nonlinear. The brightness of H2 band emission appears to be relatively more stable than H Ly alpha. There is evidence in IUE observations of a moderate increase in H2 band brightness with increasing time at Jupiter, in opposition to the variation in H Ly alpha.

11976 (ESA-SP—281-VOL-1, pp 97-100) **Phenomenological analysis of Jovian north auroral H2 Lyman band emissions.** Livengood, T.A.; Moos, H.W.; Ballester, G.E. Jun 1988. NTIS, PC A19/MF A01; ESA Publications Div., ESTEC, Noordwijk, Netherlands, 140 Dutch guilders. (ETN—88-93155; CONF-8804199—).

From A decade of UV astronomy with the IUE satellite; Greenbelt, MD, USA (1 Apr 1988).

Low-dispersion spectra taken with the IUE SWP from 1981 to 1988 are examined for gross longitudinal features in Jovian north auroral emission activity and for evidence of long-term trends in auroral characteristics. Integrated photon flux in the H2 Lyman-

band region is extracted from each of the spectra, characterizing auroral emission strength at time of exposure. A plot of flux vs Jovian central meridian longitude (System III) corroborates an enhanced emission region centered at 180 deg reported by Skinner et al., (1984). Curves fit to fluxes grouped as scans (consecutive exposures made over a single Jovian rotation) vs longitude characterize width, position, and intensity of the enhanced region. Long-term variation in auroral peak intensity and width of the enhanced region vs time, as well as possible correlation of the light curve integrated over longitude as a measure of total power emitted, vs the longitudinal position of the intensity peak were studied. More energetic aurorae appear to peak at values of central meridian longitude lower than the previously reported 180 deg. Longitudinal dependence in the ratio of photon flux in the Lyman and Werner bands, an indicator of primary particle energy, is analyzed.

11977 (ESA-SP—281-VOL-1, pp 103-106) **Observations of SN 1987A: the narrow emission lines.** Panagia, N. Jun 1988. NTIS, PC A19/MF A01; ESA Publications Div., ESTEC, Noordwijk, Netherlands, 140 Dutch guilders. (ETN—88-93155; CONF-8804199—).

From A decade of UV astronomy with the IUE satellite; Greenbelt, MD, USA (1 Apr 1988).

The IUE observations of narrow emission lines of He2, CIII, NIII, NIV, NV, and OIII in the short wavelength spectrum of SN 1987A are presented. It is shown that they originate from a circumstellar shell, which is at least a light year in size and whose nitrogen abundance relative to both carbon and oxygen is greatly enhanced as compared with cosmic values. Because of its characteristics, this shell is likely to be the remnant of the wind ejected by the progenitor star when it was a red supergiant.

11978 (ESA-SP—281-VOL-1, pp 107-110) **Progenitor of SN 1987A.** Sonneborn, G. Jun 1988. NTIS, PC A19/MF A01; ESA Publications Div., ESTEC, Noordwijk, Netherlands, 140 Dutch guilders. (ETN—88-93155; CONF-8804199—).

From A decade of UV astronomy with the IUE satellite; Greenbelt, MD, USA (1 Apr 1988).

Spatially resolved IUE spectra (1150 to 2000 A) taken at the position of SN 1987A in March 1987 show that the 12th mag B3 I star Sk -69 deg 202 disappeared. Only the fainter companion stars (Star 2 and Star 3) are present near the site of the supernova. It is concluded that Sk -69 deg 202 exploded to produce SN 1987A. The known characteristics of Sk -69 deg 202 are consistent with the interpretation that the progenitor was a relatively compact star, having a high-velocity low-density stellar wind prior to the outburst. Recent IUE spectra of SN 1987A (May 1988) show no evidence that Sk -69 deg 202 still exists inside the expanding ejecta.

11979 (ESA-SP—281-VOL-1, pp 111-113) **Complete visual light curve of SN 1987A: Thirteen months of FES observations.** Sonneborn, G. Jun 1988. NTIS, PC A19/MF A01; ESA Publications Div., ESTEC, Noordwijk, Netherlands, 140 Dutch guilders. (ETN—88-93155; CONF-8804199—).

From A decade of UV astronomy with the IUE satellite; Greenbelt, MD, USA (1 Apr 1988).

Visual brightness measurements of SN 1987A are being obtained with the IUE acquisition camera and star tracker Fine Error Sensor, (FES) as part of each ultraviolet observation. Due to IUE's around-the-clock operation and lack of clouds, the FES record of SN 1987A provides the most complete set of visual photometry of the supernova made by any single instrument. The data illustrate the photometric limitations of the FES (+ or - 0.03 mag). Use of differential photometric methods are recommended for IUE observers desiring accurate photometry from FES measurements made during their observing shifts.

11980 (ESA-SP—281-VOL-1, pp 117-120) **IUE observations of oxygen-rich supernova remnants.** Blair, W.P.; Raymond, J.C.; Danziger, J.; Matteucci, F. (European Southern Observatory, Garching (West Germany)). Jun 1988. NTIS, PC A19/MF A01; ESA Publications Div., ESTEC, Noordwijk, Netherlands, 140 Dutch guilders. (ETN—88-93155; CONF-8804199—).

From A decade of UV astronomy with the IUE satellite; Greenbelt, MD, USA (1 Apr 1988).

The IUE observations were used to determine the composition of the ejecta (especially C and Si abundances) and to test models for the ionization and excitation of the ejecta of two oxygen-rich supernova remnants (N132D in the Large Magellanic Cloud and 1E 0102-7219 in the Small Magellanic Cloud). Time-dependent photoionization by the EUV and X-ray radiation from 1E 0102-7219 can qualitatively explain its UV and optical line emission, but the density and ionization structures are complex and prevent a unique model from being specified. Many model parameters are poorly constrained, including the time dependence and shape of the ionizing spectrum. Moreover, the models presented are not self-consistent in that the volumes and densities of the optically emitting gas imply optical depths of order unity in the EUV, but absorption of the ionizing radiation was ignored. It is possible that these shortcomings reflect a more fundamental limitation of the model assumptions. It is assumed that the electron velocity distribution is Maxwellian and that the energy deposited by photoionization heats the electrons directly. The 500 eV electrons produced by the Auger process may excite or ionize other ions before they slow down enough to share their energy with other electrons. Many of the excitations would produce photons that could ionize lower ionization stages.

11981 (ESA-SP—281-VOL-1, pp 121-124) **Ejecta in SN 1006: the knotty issue.** Fesen, R.A.; Hamilton, A.J.S. (Joint Inst. for Lab. Astrophysics, Boulder, CO (USA)). Jun 1988. NTIS, PC A19/MF A01; ESA Publications Div., ESTEC, Noordwijk, Netherlands, 140 Dutch guilders. (ETN—88-93155; CONF-8804199—).

From A decade of UV astronomy with the IUE satellite; Greenbelt, MD, USA (1 Apr 1988).

The 1988 IUE SWP observations of a faint sdOB star situated behind the remnant of the supernova of AD 1006 are presented. These spectra along with IUE spectra of the star taken between 1982 and 1986 provide a detailed look at the elemental composition and dynamical properties of the SN 1006 remnant. Over the 6 years there were no significant changes in the absorption features associated with the remnant at 1281, 1330, or 1420 A. While the lack of variability in these absorption lines makes it impossible to decide whether the ejecta is distributed smoothly or in knots, it is clear that the 1281 A feature is a blend, requiring either S II absorption redshifted at 6000 km/sec plus Si II 1260 at 5200 km/sec, or else 2 individual Si absorbing regions.

11982 (ESA-SP—281-VOL-1, pp 137-140) **Simultaneous IUE, EXOSAT and optical observations of the unusual AM Her type variable H058+608.** Shrader, C.R.; Mcclintock, J.E.; Remillard, R.; Silber, A.; Lamb, D.Q. (Chicago Univ., IL (USA)). Jun 1988. NTIS, PC A19/MF A01; ESA Publications Div., ESTEC, Noordwijk, Netherlands, 140 Dutch guilders. (ETN—88-93155; CONF-8804199—).

From A decade of UV astronomy with the IUE satellite; Greenbelt, MD, USA (1 Apr 1988).

Simultaneous observations of the AM Her type variable H0538+608 made with IUE, EXOSAT, and a 1.3 m ground based telescope, and subsequent optical spectrophotometry at high and low resolution are discussed. The X-ray and optical data show clear evidence of a 3.30 + or - 0.03 hr period. Three SWP spectra were taken outside of eclipse and during overlapping phase intervals. The UV spectra contain strong emission lines characteristic of this class of objects and a flat continuum which appears to be deficient, given the brightness of source at optical and X-ray wavelengths. There is evidence for intensity variations in emission lines, particularly C IV. The X-ray light curves for H0538+608 reveal behavior which may be related to irregularities in its accretion flow.

11983 (ESA-SP—281-VOL-1, pp 149-152) **Analysis of spectra of novae taken near maximum.** Stryker, L.L.; Hestand, J.; Starrfield, S.; Wehrse, R.; Hauschildt, P.; Spies, W.; Baschek, B.; Shaviv, G. (Technion - Israel Inst. of Tech., Haifa). Jun 1988. NTIS, PC A19/MF A01; ESA Publications Div., ESTEC, Noordwijk, Netherlands, 140 Dutch guilders. (ETN—88-93155; CONF-8804199—).

From A decade of UV astronomy with the IUE satellite; Greenbelt, MD, USA (1 Apr 1988).

A project to analyze ultraviolet spectra of novae obtained at or near maximum optical light is presented. These spectra are characterized by a relatively cool continuum with superimposed permitted emission lines from ions such as Fe II, Mg II, and Si II. Spectra obtained late in the outburst show only emission lines from highly ionized species and in many cases these are forbidden lines. The ultraviolet data will be used with calculations of spherical, expanding, stellar atmospheres for novae to determine elemental abundances by spectral line synthesis. This method is extremely sensitive to the abundances and completely independent of the nebular analyses usually used to obtain novae abundances.

11984 (ESA-SP—281-VOL-1, pp 155-157) **1981 outburst of the old nova GK Persei.** Wu, C.C.; Panek, R.J.; Holm, A.V.; Raymond, J.C.; Hartmann, L.W.; Swank, J.H. (Harvard-Smithsonian Center for Astrophysics, Cambridge, MA (USA)). Jun 1988. NTIS, PC A19/MF A01; ESA Publications Div., ESTEC, Noordwijk, Netherlands, 140 Dutch guilders. (ETN—88-93155; CONF-8804199—).

From A decade of UV astronomy with the IUE satellite; Greenbelt, MD, USA (1 Apr 1988).

Old nova GK Per was observed in 1981 with the IUE, during its rise, maximum, and subsequent return to minimum. In outburst, GK Per is luminous but much redder than dwarf novae or standard model accretion disks. The observed spectrum can be explained qualitatively with the Ghosh and Lamb (1979) model for the interaction of an accretion disk with the magnetic field of the accreting white dwarf. The N V and He2 are enhanced relative to other emission lines during outburst. This can be understood with photoionization by very soft X-rays having a luminosity comparable to that of the hard X-rays.

11985 (ESA-SP—281-VOL-1, pp 159-161) **Observations of classical novae in outburst.** Starrfield, S.; Stryker, L.L.; Sonneborn, G.; Sparks, W.M.; Ferland, G.; Wagner, R.M.; Williams, R.E.; Gehrz, R.D.; Ney, E.P.; Kenyon, S. (Harvard Univ., Boston, MA (USA)). Jun 1988. NTIS, PC A19/MF A01; ESA Publications Div., ESTEC, Noordwijk, Netherlands, 140 Dutch guilders. (ETN—88-93155; CONF-8804199—).

From A decade of UV astronomy with the IUE satellite; Greenbelt, MD, USA (1 Apr 1988).

The IUE obtained ultraviolet data on novae in outburst. The characteristics of every one of the outbursts are different. Optical and infrared data on many of the same novae were also obtained. Three members of the carbon-oxygen class of novae are presented.

11986 (ESA-SP—281-VOL-1, pp 163-166) **Observations and simulations of nova Vul 1984 no. 2: a nova with ejecta rich in oxygen, neon, and magnesium.** Starrfield, S.; Sonneborn, G.; Stryker, L.L.; Sparks, W.M.; Truran, J.W.; Ferland, G.; Wagner, R.M.; Gallagher, J.S.; Wade, R.; Williams, R.E. (Cerro Tololo Inter-American Observatory, La Serena (Chile)). Jun 1988. NTIS, PC A19/MF A01; ESA Publications Div., ESTEC, Noordwijk, Netherlands, 140 Dutch guilders. (ETN—88-93155; CONF-8804199—).

From A decade of UV astronomy with the IUE satellite; Greenbelt, MD, USA (1 Apr 1988).

Nova Vul 1984 no. 2 was observed with IUE from Dec. 1984 through Nov. 1987. The spectra are characterized by strong lines from Mg, Ne, C, Si, O, N, and other elements. Data obtained in the ultraviolet, infrared, and optical show that this nova is ejecting material rich in oxygen, neon, and magnesium.

11987 (ESA-SP—281-VOL-1, pp 167-170) **Observations and simulations of recurrent novae: U Sco and V394 CrA.** Starrfield, S.; Sonneborn, G.; Sparks, W.M.; Shaviv, G.; Williams, R.E.; Heathcote, S.; Ferland, G.; Gehrz, R.D.; Ney, E.P.; Kenyon, S. (Minnesota Univ., Minneapolis (USA)). Jun 1988. NTIS, PC A19/MF A01; ESA Publications Div., ESTEC, Noordwijk, Netherlands, 140 Dutch guilders. (ETN—88-93155; CONF-8804199—).

From A decade of UV astronomy with the IUE satellite; Greenbelt, MD, USA (1 Apr 1988).

Observations and analysis of the Aug. 1987 outburst of the recurrent nova V394 CrA are presented. This nova is extremely fast and its outburst characteristics closely resemble those of the recurrent nova U Sco. Hydrodynamic simulations of the outbursts of recurrent novae were performed. Results as applied to the outbursts of V394 CrA and U Sco are summarized.

11988 (ESA-SP—281-VOL-1, pp 171-173) **Optical and ultraviolet observations of nova Vul 1987.** Starrfield, S.; Stryker, L.L.; Sonneborn, G.; Sparks, W.M.; Wagner, R.M.; Ferland, G.; Gallagher, J.S.; Wade, R.; Williams, R.E.; Gehrz, R.D. (Minnesota Univ., Minneapolis (USA)). Jun 1988. NTIS, PC A19/MF A01; ESA Publications Div., ESTEC, Noordwijk, Netherlands, 140 Dutch guilders. (ETN—88-93155; CONF-8804199—).

From A decade of UV astronomy with the IUE satellite; Greenbelt, MD, USA (1 Apr 1988).

The outburst for a nova discovered in Nov. 1987 and followed since then is summarized. Although it was possible to observe it with the IUE at maximum, its ultraviolet energy faded rapidly, and after the first 2 weeks it was impossible to observe it at IUE wavelengths. It is observed to form a thick dust shell and is in the nebular stage.

11989 (ESA-SP—281-VOL-1, pp 175-177) **Ultraviolet observations of LMC nova 1988.** Starrfield, S.; Stryker, L.L.; Sonneborn, G.; Sparks, W.M.; Sion, E.M.; Wagner, R.M.; Ferland, G.; Gallagher, J.S.; Wade, R.; Williams, R.E. (Cerro Tololo Inter-American Observatory, La Serena (Chile)). Jun 1988. NTIS, PC A19/MF A01; ESA Publications Div., ESTEC, Noordwijk, Netherlands, 140 Dutch guilders. (ETN—88-93155; CONF-8804199—).

From A decade of UV astronomy with the IUE satellite; Greenbelt, MD, USA (1 Apr 1988).

The IUE obtained ultraviolet spectra of a nova in an external galaxy. The spectral features do not seem unusual for a nova at maximum but it is hoped to be able to follow it for a long enough time to be able to study the high ionization lines that appear when the density drops to lower values (the nebular stage). A high dispersion spectrum was also obtained to assist in the line identification and to study the line of sight to the LMC 1 deg of arc away from SN 1987A.

11990 (ESA-SP—281-VOL-1, pp 179-181) **SS Cygni in quiescence.** Holm, A.V.; Polidan, R.S. (Arizona Univ., Tucson (USA)). Jun 1988. NTIS, PC A19/MF A01; ESA Publications Div., ESTEC, Noordwijk, Netherlands, 140 Dutch guilders. (ETN—88-93155; CONF-8804199—).

From A decade of UV astronomy with the IUE satellite; Greenbelt, MD, USA (1 Apr 1988).

Low reslution IUE spectra of SS Cygni obtained near quiescence show a strong absorption feature near 1225A. If this feature is interpreted as the red wing of the Lyman alpha absorption in the spectrum of the white dwarf component, then the star has an effective temperature of 34,000 + or - 5000 K. This information is used to derive limits on the distance. Observations obtained in outburst are used to determine an E(B-V) estimate of 0.04 + or - 0.02. While these observations are consistent with the detection of the white dwarf primary they also show that the disk itself can produce Lyman alpha absorption resembling that of a white dwarf and that the existence of the feature is not proof that the white dwarf is detected.

11991 (ESA-SP—281-VOL-1, pp 187-190) **IUE observations of the 1987 superoutburst of the dwarf nova Z Cha.** Harlaftis, E.; Hassall, B.J.M.; Sonneborn, G.; Naylor, T.; Charles, P.A. (European Space Agency, Madrid (Spain)). Jun 1988. NTIS, PC A19/MF A01; ESA Publications Div., ESTEC, Noordwijk, Netherlands, 140 Dutch guilders. (ETN—88-93155; CONF-8804199—).

From A decade of UV astronomy with the IUE satellite; Greenbelt, MD, USA (1 Apr 1988).

Low resolution IUE observations of the dwarf nova Z Cha during superoutburst are presented. These cover most of the development of the outburst and have sufficient time resolution to probe continuum and line behavior on orbital phase. The observed modu-

lation on this phase is very similar to that observed in the related object OY Car. The results imply the presence of a cool spot on the edge of the edge of the accretion disk, which periodically occults the brighter inner disk. Details of the line behavior suggest that the line originated in an extended wind-emitting region. In contrast to archive spectra obtained in normal outburst, the continuum is fainter and redder, indicating that the entire superoutburst disk may be geometrically thicker than during a normal outburst.

11992 (ESA-SP—281-VOL-1, pp 193-195) **Observations of galactic WC + O binary systems: HD 97152 and HD 152270.** Auer, L.H.; Colome, C.; Koenigsberger, G. (Universidad Autonoma de Madrid, Cantoblanco (Spain)). Jun 1988. NTIS, PC A19/MF A01; ESA Publications Div., ESTEC, Noordwijk, Netherlands, 140 Dutch guilders. (ETN—88-93155; CONF-8804199—).

From A decade of UV astronomy with the IUE satellite; Greenbelt, MD, USA (1 Apr 1988).

The IUE observations of the Wolf-Rayet binary systems HD 97152 and HD 152270 are presented. Both systems contain a WC7 component, and both have relatively small orbital inclinations. Weak atmospheric eclipses at emission line wavelengths are detected in HD 97152, the system for which a more suitable phase coverage is available.

11993 (ESA-SP—281-VOL-1, pp 201-203) **Mass flow in the interacting binary TX Ursae Majoris.** McCluskey, G.E. Jr.; McCluskey, C.P.S.; Kondo, Y. (Pennsylvania State Univ., University Park (USA)). Jun 1988. NTIS, PC A19/MF A01; ESA Publications Div., ESTEC, Noordwijk, Netherlands, 140 Dutch guilders. (ETN—88-93155; CONF-8804199—).

From A decade of UV astronomy with the IUE satellite; Greenbelt, MD, USA (1 Apr 1988).

Twenty-two far-ultraviolet and 23 near-ultraviolet high resolution IUE spectra of the interactive Algol-type binary TX Ursae Majoris (B8 V + F-K III-IV) were analyzed in order to determine the nature of the mass flow occurring in this system. Absorption features due to high-temperature ions of Si IV, C IV, and N V are always present. The resonance lines of Al III, Fe II, Mg II and Si IV show strong phase and secular variations indicative of gas streaming and circumstellar/circumbinary material. Radial velocities as high as 500 to 600 km/sec are present. The gas flow is particularly prominent in 1985 between phases 0.7 and 0.0. The system is more active than U Sagittae and as active as U Cephei.

11994 (ESA-SP—281-VOL-1, pp 205-208) **New study of the interacting binary star V356 Sgr.** Polidan, R.S. Jun 1988. NTIS, PC A19/MF A01; ESA Publications Div., ESTEC, Noordwijk, Netherlands, 140 Dutch guilders. (ETN—88-93155; CONF-8804199—).

From A decade of UV astronomy with the IUE satellite; Greenbelt, MD, USA (1 Apr 1988).

Results on V356 Sgr from IUE and Voyager ultraviolet (500 to 3200 A) observations obtained in 1986 and 1987, primarily during 2 total eclipses are presented. The eclipse of Aug. 15, 1986 was fully covered with IUE low dispersion images and 9 hr of Voyager UVS data. The eclipse of Mar. 25, 1987 was covered with IUE low dispersion images and 1 high dispersion SWP image. During both eclipses the total strength of the emission lines is found to be invariant. An uneclipsed UV continuum is detected at wavelengths shorter than 1500 A. The high dispersion SWP spectrum reveals that the emission lines are extremely broad, almost symmetrical emissions with weak, slightly blue shifted absorption components. No evidence of carbon, C I, C II, C III, or C IV, is seen in the emission or absorption spectrum of V356 Sgr in eclipse. Models for this binary system are presented.

11995 (ESA-SP—281-VOL-1, pp 213-215) **November 1987 eclipse of the zeta-Aur system HR 2554.** Ake, T.B. III; Parsons, S.B. Jun 1988. NTIS, PC A19/MF A01; ESA Publications Div., ESTEC, Noordwijk, Netherlands, 140 Dutch guilders. (ETN—88-93155; CONF-8804199—).

From A decade of UV astronomy with the IUE satellite; Greenbelt, MD, USA (1 Apr 1988).

It is confirmed that HR 2554 (G6 II + A0 V) is an atmospheric eclipsing system of the zeta-Aur type. The IUE observations of the Nov. 1987 eclipse indicate that the eclipse of the A star lasts 4 days and is not total. Absorption lines due to the extended atmosphere of the primary can be seen a day before and after the eclipse and are missing 2 days from first and 4th contact. Thus the outer envelope of the primary extends to less than 1 stellar radius beyond the photosphere. Compared to 22 Vul (G3 Ib-II + B9 V), where the absorption can be traced to a few stellar radii, HR 2554 is a more moderate case of mass outflow, which implies there is reduced interaction of the secondary within the wind from the primary as is seen in the other zeta-Aur systems.

11996 (ESA-SP—281-VOL-1, pp 217-220) **Asymmetry in zeta Auriage chromospheres.** Ahmad, I.A. Jun 1988. NTIS, PC A19/MF A01; ESA Publications Div., ESTEC, Noordwijk, Netherlands, 140 Dutch guilders. (ETN—88-93155; CONF-8804199—).

From A decade of UV astronomy with the IUE satellite; Greenbelt, MD, USA (1 Apr 1988).

Asymmetry in the ultraviolet spectra of zeta-Aur, similar to that reported in optical observations, was studied using IUE data. A plot of the integrated flux of zeta Aurigae from 1625 to 1675 A as a function of absolute phase shows no significant difference between the ingress and egress phases. A plot of the integrated flux from 1625 to 1675 A for 22 Vul as a function of absolute phase for both ingress and egress confirms that the atmospheric eclipse is asymmetric in 22 Vul. The eclipse in 22 Vul begins symmetrically but departs from symmetry at a phase greater than 0.05. The pronounced dip at ingress suggests a feature in the chromosphere.

11997 (ESA-SP—281-VOL-1, pp 221-224) **Superionized plasmas in Algol binaries.** Plavec, M.J. Jun 1988. NTIS, PC A19/MF A01; ESA Publications Div., ESTEC, Noordwijk, Netherlands, 140 Dutch guilders. (ETN—88-93155; CONF-8804199—).

From A decade of UV astronomy with the IUE satellite; Greenbelt, MD, USA (1 Apr 1988).

Outflowing gas is studied for semidetached binaries of the Algol type. A survey of 11 systems observed during the total primary eclipse shows that the same type of emission-line spectrum appears, but that important differences exist, correlated with the character of the mass-accreting star, although it is not clear if the correlation is with spectral type or with mass. The line emitting plasma is specified, but the dominant electron temperature varies from system to system and determines the relative line strengths. Evidence for CNO processing, affecting the abundance ratios C/N, is also present.

11998 (ESA-SP—281-VOL-1, pp 225-227) **HD 207739 and other F + Be variables.** Parsons, S.B.; Dempsey, R.C.; Bopp, B.W. (Ritter Observatory, Toledo, OH (USA)). Jun 1988. NTIS, PC A19/MF A01; ESA Publications Div., ESTEC, Noordwijk, Netherlands, 140 Dutch guilders. (ETN—88-93155; CONF-8804199—).

From A decade of UV astronomy with the IUE satellite; Greenbelt, MD, USA (1 Apr 1988).

Characteristics for a group of composite spectrum stars which have strong H alpha emission and peculiar satellite UV spectra are compared. Spectroscopic periods and photometric variability are discussed. Compared with normal noninteracting composite spectrum binaries, they exhibit excess flux in the middle UV region. This is believed to indicate the presence of an accretion disk.

11999 (ESA-SP—281-VOL-1, pp 229-231) **Searching for the white dwarf in WZ Sagittae.** Holm, A.V. Jun 1988. NTIS, PC A19/MF A01; ESA Publications Div., ESTEC, Noordwijk, Netherlands, 140 Dutch guilders. (ETN—88-93155; CONF-8804199—).

From A decade of UV astronomy with the IUE satellite; Greenbelt, MD, USA (1 Apr 1988).

Far ultraviolet IUE spectra of WZ Sge from July 1979 through Nov. 1981 were studied to search for the spectroscopic signature of the white dwarf primary. The ultraviolet fluxes continue to decline throughout this period. The ultraviolet spectrum of WZ Sge near minimum is not completely consistent with the hypothesis that the white dwarf is visible, although the ultraviolet energy distribution can be matched by a DA-type white dwarf.

This does not explain the behavior of the absorption spectrum. However, the accretion on the top of the atmosphere of material having normal metal abundances might greatly alter the appearance of the spectrum. Development of model atmospheres having solar abundances for white dwarfs is recommended to investigate this possibility. Models of white dwarfs heated by a bright accretion disk are also needed to determine whether this mechanism could cause the surface temperature to be high for several years after the outburst.

12000 (ESA-SP—281-VOL-1, pp 237-239) **Cepheid binaries with large mass ratios (M1/M2).** Evans, N.R. Jun 1988. NTIS, PC A19/MF A01; ESA Publications Div., ESTEC, Noordwijk, Netherlands, 140 Dutch guilders. (ETN—88-93155; CONF-8804199—).

From A decade of UV astronomy with the IUE satellite; Greenbelt, MD, USA (1 Apr 1988).

The IUE observations of 3 Cepheid systems (Polaris, FF Aql, and S Sge) are used to derive, or set limits on, the temperatures and masses of the companions. Light from the companions of FF Aql and S Sge from 1700 to 2000 A is consistent with an A5 to A7 main sequence companion for both Cepheids, with a mass of 1.8 solar mass. This mass for the companion of S Sge is smaller than required by the orbital mass function and an evolutionary mass of the Cepheid, suggesting that the companion may itself be a binary. For Polaris, the mass of the companion must be less than 1.8 solar mass.

12001 (ESA-SP—281-VOL-1, pp 241-243) **Orbit of the Cepheid AW Per.** Evans, N.R.; Welch, D.L. Jun 1988. NTIS, PC A19/MF A01; ESA Publications Div., ESTEC, Noordwijk, Netherlands, 140 Dutch guilders. (ETN—88-93155; CONF-8804199—).

From A decade of UV astronomy with the IUE satellite; Greenbelt, MD, USA (1 Apr 1988).

An orbit for the classical Cepheid AW Per was derived. Phase residuals from the light curve are consistent with the light-time effect from the orbit. The companion was studied using IUE spectra. The flux distribution from 1300 to 1700 A is unusual, probably an extreme PbSi star, comparable to a B7V or B8V star. The flux of the composite spectrum from 1200 A through V is well matched by F7Ib and B8V standard stars with Delta M(sub upsilon) = 3(m) multiplied by 1. The mass function from the orbit indicates that the mass of the Cepheid must be greater that 4.7 solar mass if it is the more massive component. A B7V to B8V companion is compatible with the 1 sigma lower limit (3.5 solar mass) from the mass function. This implies that the Cepheid has the same mass, but the large magnitude difference rules this out. It is likely that the companion is itself a binary.

12002 (ESA-SP—281-VOL-1, pp 245-248) **Companions to peculiar red giants: HR 363 and HR 1105.** Ake, T.B. III; Johnson, H.R.; Perry, B.F. Jr. (Howard Univ., Washington, DC (USA)). Jun 1988. NTIS, PC A19/MF A01; ESA Publications Div., ESTEC, Noordwijk, Netherlands, 140 Dutch guilders. (ETN—88-93155; CONF-8804199—).

From A decade of UV astronomy with the IUE satellite; Greenbelt, MD, USA (1 Apr 1988).

Recent IUE observations of two Tc-deficient S-type peculiar red giants that are also spectroscopic binaries, HR 363 and HR 1105 are reported. A 675 min SWP exposure of HR 363 shows emission lines of O I 1304 and Si II 1812 and a trace of continuum. Compared to the M giants, the far UV flux may be relatively larger, indicating a possible contribution from a white dwarf companion, but no high temperature emission lines are seen to indicate that this is an interacting system where mass-transfer recently occurred. However, HR 1105 appears to have a highly variable UV companion. In 1982, no UV flux was discerned for this system, but by 1986 C IV was strong, increasing by a factor of 3 in 1987 with prominent lines of Si III, C III, O III, Si IV, and N V. Using orbital parameters, these observations are consistent with high activity occuring when the side of the S-star primary illuminated by the companion faces the Earth, but since the IUE data were taken over 3 orbits, a secular change in the UV component cannot be excluded.

12003 (ESA-SP—281-VOL-1, pp 249-252) **Direct UV observations of the circumstellar envelope of alpha Orionis.** Stencel, R.E.; Carpenter, K.G.; Pesce, J.E.; Skinner, S.; Brown, A.; Judge, P. (Joint Inst. for Lab. Astrophysics, Boulder, CO (USA)). Jun 1988. NTIS, PC A19/MF A01; ESA Publications Div., ESTEC, Noordwijk, Netherlands, 140 Dutch guilders. (ETN—88-93155; CONF-8804199—).

From A decade of UV astronomy with the IUE satellite; Greenbelt, MD, USA (1 Apr 1988).

Observations were made in the IUE LWP camera, low dispersion mode, with alpha Ori being offset various distances from the center of the Long Wavelength Large Aperture along its major axis. Signal was acquired at all offset positions and is comprised of unequal components of background/dark counts, telescope-scattered light, and scattered light emanating from the extended circumstellar shell. The star is known from optical and infrared observations to possess an extended, arc-minute sized, shell of cool material. Attempts to observe this shell with the IUE are described, although the deconvolution of the stellar signal from the telescope scattered light requires further calibration effort.

12004 (ESA-SP—281-VOL-1, pp 253-256) **Multi-wavelength observations of the peculiar red giant HR 3126.** Pesce, J.E.; Stencel, R.E.; Walter, F.M.; Doggett, J.; Dachs, J.; Whitelock, P.BA.; Mundt, R. (Max-Planck-Inst. fuer Astronomie, Heidelberg (West Germany)). Jun 1988. NTIS, PC A19/MF A01; ESA Publications Div., ESTEC, Noordwijk, Netherlands, 140 Dutch guilders. (ETN—88-93155; CONF-8804199—).

From A decade of UV astronomy with the IUE satellite; Greenbelt, MD, USA (1 Apr 1988).

Ultraviolet observations of the red giant HR 3126 are combined with multi-wavelength data in order to provide a firmer basis for explaining the arc-minute sized nebula surrounding the object. Possibilities as to the location of HR 3126 on the Hertzsprung-Russel diagram, and to the formation mechanisms of the reflection nebula IC 2220 associated with it, are summarized.

12005 (ESA-SP—281-VOL-1, pp 257-260) **Recurrent shell infall events in a B0.5e star: HD 58978 1979-1988.** Grady, C.A.; Peters, G.J.; Bjorkman, K.S.; Henrichs, H.F. (Amsterdam Univ. (Netherlands)). Jun 1988. NTIS, PC A19/MF A01; ESA Publications Div., ESTEC, Noordwijk, Netherlands, 140 Dutch guilders. (ETN—88-93155; CONF-8804199—).

From A decade of UV astronomy with the IUE satellite; Greenbelt, MD, USA (1 Apr 1988).

Infall from the circumstellar envelope onto the bright B0.5 IVe star, HD 58978 was studied. The IUE data indicate that the star was surrounded by a low and moderately ionized circumstellar shell at least 12 times between 1979 and 1988. During 6 of these episodes, the signatures of cool circumstellar material were redshifted with respect to the photosphere by 20 to 80 km/sec. The data indicate that the transition from infall to minimal shell absorption can occur in under 10 days, and are consistent either with infall phases lasting up to 6 months, or with infall episodes shorter than 10 to 15 days. The long term behavior of the shell episodes is compared with variability in the stellar wind.

12006 (ESA-SP—281-VOL-1, pp 263-265) **IUE observations of a hot DAO white dwarf: implications for diffusion theory and photospheric stratification.** Holberg, J.B.; Sion, E.M.; Liebert, J.; Vauclair, G. (Observatoire du Pic-du-Midi, Bagneres de Bigorre (France)). Jun 1988. NTIS, PC A19/MF A01; ESA Publications Div., ESTEC, Noordwijk, Netherlands, 140 Dutch guilders. (ETN—88-93155; CONF-8804199—).

From A decade of UV astronomy with the IUE satellite; Greenbelt, MD, USA (1 Apr 1988).

Observations of the DAO white dwarf PG1210+533, including the first high dispersion spectrum of a hybrid H-He object of this nature were obtained by IUE. In contrast with hot DAs in the 50,000 K temperature range, PG1210+533 shows no narrow interstellar-like metal lines, in spite of an optically observed He/H abundance of 0.1. This lack of metal makes accretion from the ISM an unlikely source for the He in the PG1210+533 photosphere. A

significant discovery in the high dispersion spectrum is the existence of a sharp, non-LTE like, core seen in the He II 1640 line. Such features are detected in DO white dwarfs. A small aperture SWP low dispersion observation reveals the Lyman alpha profile of PG1210+533 to be surprisingly weak and narrow. Fits of this profile using pure H models yielded a T(eff) = 56,000 K. Fits of the Balmer H gamma profile however, yield T(eff) = 42,300 K and log g = 8.5 + or - 0.5 for the same models. It is unlikely that homogeneously mixed H-He atmospheres can resolve the inconsistency between the Lyman alpha and H gamma features in this star. Stratified models involving thin H photospheres may be necessary to explain these results.

12007 (ESA-SP—281-VOL-1, pp 267-270) **Temperature determinations of hot DA white dwarfs using IUE continuum fluxes.** Finley, D.; Basri, G.; Bowyer, S. Jun 1988. NTIS, PC A19/MF A01; ESA Publications Div., ESTEC, Noordwijk, Netherlands, 140 Dutch guilders. (ETN—88-93155; CONF-8804199—).

From A decade of UV astronomy with the IUE satellite; Greenbelt, MD, USA (1 Apr 1988).

Effective temperatures of 15 DA white dwarfs hotter than 20,000 K were derived from low-dispersion far ultraviolet spectra obtained with IUE. The analysis was carried out by comparing the observed far ultraviolet fluxes with model fluxes scaled to the V-band flux. Accurate calibration of the IUE spectra is critical for this analysis. Observations at all epochs were corrected to the 1980 IUE calibration using the time-dependent corrections of Bohlin (1988). Taking advantage of the smooth and well-defined continuum fluxes provided by DA white dwarfs, seven white dwarfs for which accurate, independent temperature determinations were made from line profile analyses were used to improve the accuracy of the IUE flux calibration. The correction to the original calibration is as great as 20 percent in individual 5 A wavelength bins, while the average over the IUE wavelength range is 5 percent. The final calibration correction and the temperatures for the hot white dwarfs are presented.

12008 (ESA-SP—281-VOL-1, pp 279-282) **IUE observations of rapidly rotating K dwarfs in the Pleiades.** Simon, T. Jun 1988. NTIS, PC A19/MF A01; ESA Publications Div., ESTEC, Noordwijk, Netherlands, 140 Dutch guilders. (ETN—88-93155; CONF-8804199—).

From A decade of UV astronomy with the IUE satellite; Greenbelt, MD, USA (1 Apr 1988).

Low-resolution Mg II spectra were obtained with the IUE for rapidly rotating, spotted K dwarf stars in the Pleiades cluster. The observations show an order of magnitude spread in the chromospheric emission of presumably coeval members of the cluster. The emission is correlated with the stellar rotation rate, being strongest for stars having periods of less than 1 day and weakest for more slowly rotating stars. The strength of the emission of the rapid rotators lies well above the emission levels that characterize the most active solar-type stars in the field and is significant stronger than the Mg II emission observed for low-mass pre-main sequence stars. The observations indicate that the decay of stellar chromospheric activity with age does not follow any simple rule, such as the square-root law or an exponential decay law.

12009 (ESA-SP—281-VOL-1, pp 291-293) **Spectral images of HD 199178.** Neff, J.E.; Vilhu, O.; Walter, F.M. (Colorado Univ., Boulder (USA)). Jun 1988. NTIS, PC A19/MF A01; ESA Publications Div., ESTEC, Noordwijk, Netherlands, 140 Dutch guilders. (ETN—88-93155; CONF-8804199—).

From A decade of UV astronomy with the IUE satellite; Greenbelt, MD, USA (1 Apr 1988).

High-resolution IUE spectra of the Mg II k line of HD 199178 were analyzed, applying spectral imaging techniques to derive an image of the chromospheric structure and to study the transient behavior of the chromosphere. All spectra in the IUE archives were uniformly reduced and analyzed. Results are compared with ground-based observations of the photosphere. Four ultraviolet flares on HD 199178 are observed; 3 of these occurred at roughly the same rotational phase. There is no clear phase-dependence of the SWP line fluxes, but there is for the Mg II k flux. The emission centroid of the Mg II k line varies in a quasi-sinusoidal fashion, presumably due to the rotation of a nonuniform chromosphere.

12010 (ESA-SP—281-VOL-1, pp 295-297) **Doppler imaging of AR Lacertae at three epochs.** Walter, F.M.; Neff, J.E.; Linsky, J.L.; Rodono, M. (Catania Univ. (Italy)). Jun 1988. NTIS, PC A19/MF A01; ESA Publications Div., ESTEC, Noordwijk, Netherlands, 140 Dutch guilders. (ETN—88-93155; CONF-8804199—).

From A decade of UV astronomy with the IUE satellite; Greenbelt, MD, USA (1 Apr 1988).

Observations from IUE were used to study the structure of the lower chromosphere of AR Lacertae in the light of Mg II k. Sequences of LWR/P-HI images distributed around the binary period at three epochs were obtained. Discrete plage-like regions of enhanced Mg II surface flux in this system are identified. There are temporal variations in the Mg II flux on timescales of hours as well as substantial changes in chromospheric morphology on timescales of years. Even with the limited S/N attainable with the IUE, one can map the gross structures of active stellar atmospheres. With such information, one can begin to study the true 3-D structure of the atmospheres of late-type stars.

12011 (ESA-SP—281-VOL-1, pp 299-302) **Rotational modulation of hydrogen Lyman alpha flux from 44ii Bootis.** Vilhu, O.; Neff, J.E.; Rahunen, T. (Joint Inst. for Lab. Astrophysics, Boulder, CO (USA)). Jun 1988. NTIS, PC A19/MF A01; ESA Publications Div., ESTEC, Noordwijk, Netherlands, 140 Dutch guilders. (ETN—88-93155; CONF-8804199—).

From A decade of UV astronomy with the IUE satellite; Greenbelt, MD, USA (1 Apr 1988).

Observations with IUE that cover the entire 6.4 hr orbital cycle of the late-type contact binary 44i Bootis are presented. Intrinsic stellar hydrogen Lyman alpha emission flux was determined from low-resolution IUE spectra, compensating for geocoronal emission and for interstellar absorption. The variation of the stellar Lyman alpha emission flux correlates well with the variation of the C II and C IV emission fluxes, and shows orbital modulation in phase with the visual light curve. The ratio of Lyman alpha to CII flux (15 to 20) is similar to that observed in solar active regions. Hydrogen Lyman alpha emission is thus one of the most important cooling channels in the outer atmosphere of 44i Boo. A high-resolution spectrum of the Lyman alpha line was obtained between orbital phases 0.0 and 0.6. The integrated flux in the observed high-resolution Lyman alpha profile is consistent with the fluxes determined using low-resolution spectra, and the composite profile indicates that both components of this binary have equally active chromospheres and transition regions. The uncertainty in the interstellar hydrogen column density cannot mimic the observed variation in the integrated Lyman alpha flux, because the stellar line is very much broader than the interstellar absorption.

12012 (ESA-SP—281-VOL-1, pp 303-306) **Mapping of surface activity on the W UMa-type system VW Cephei.** Bradstreet, D.H.; Guinan, E.F. Jun 1988. NTIS, PC A19/MF A01; ESA Publications Div., ESTEC, Noordwijk, Netherlands, 140 Dutch guilders. (ETN—88-93155; CONF-8804199—).

From A decade of UV astronomy with the IUE satellite; Greenbelt, MD, USA (1 Apr 1988).

After multifilter photometry of the W UMa-type contact binary VW Cep (P = 6.67 hr; G5V + K0V) in 1986/87 revealed large asymmetries in the light curves believed to be caused by large, cool starspot regions on the surface of the larger stars, in Apr. 1987 it was observed with IUE to study the chromospheres and transition regions of the components. During one complete orbital cycle, three SWP and four LWP low dispersion spectra were obtained, including and then excluding the suspected active region. Phase dependent TR line emission strengths were found, most notably C IV, which is 50 percent stronger when the spot region is most visible. The results could be important because VW Cep represents an extreme case for studying stellar dynamo theory and observations can play a crucial role in the understanding of magnetic fields and activity cycles in rapidly rotating solar-like stars.

12013 (ESA-SP—281-VOL-1, pp 315-317) **Energy input mechanism into the lower transition regions between stellar chromospheres and coronae.** Boehm-Vitense, E. Jun 1988. NTIS, PC A19/MF A01; ESA Publications Div., ESTEC, Noordwijk, Netherlands, 140 Dutch guilders. (ETN—88-93155; CONF-8804199—).

From A decade of UV astronomy with the IUE satellite; Greenbelt, MD, USA (1 Apr 1988).

The ratio of the emission line fluxes for the C II and C IV lines in the lower transition regions (T = 30,000 to 100,000 K) between stellar chromospheres and transition layers is shown to depend mainly on the temperature gradient in the line emitting regions which can therefore be determined from this line ratio. From the observed constant (within the limits of observational error) ratio of the emission line fluxes of the C II (1335 A) and C IV (1550 A) lines it is concluded that the temperature gradients in the lower transition layers are similar for the large majority of stars independently of T sub eff, L, and degree of activity. This means that the temperature dependence of the damping length for the mechanical flux must be the same for all these stars. Since for different kinds of mechanical fluxes the dependence of the damping length on gas pressure and temperature is quite different, it is concluded that the same heating mechanism must be responsible for the heating of all the lower transition layers of these stars, regardless of their chromospheric activity. Only the amount of mechanical flux changes. The T Tauri stars are exceptions: their emission lines are probably mainly due to circumstellar material.

12014 (ESA-SP—281-VOL-1, pp 323-326) **Transition region fluxes in A-F Dwarfs: basal fluxes and dynamo activity.** Walter, F.M.; Schrijver, C.J.; Boyd, W. Jun 1988. NTIS, PC A19/MF A01; ESA Publications Div., ESTEC, Noordwijk, Netherlands, 140 Dutch guilders. (ETN—88-93155; CONF-8804199—).

From A decade of UV astronomy with the IUE satellite; Greenbelt, MD, USA (1 Apr 1988).

The transition region spectra of 87 late A and early F dwarfs and subgiants were analyzed. The emission line fluxes are uniformly strong in the early F stars, and drop off rapidly among the late A stars. The basal flux level in the F stars is consistent with an extrapolation of that observed among the G stars, while the magnetic component displays the same flux-flux relations seen among solar-like stars. Despite the steep decrease in transition region emission flux for B-V less than 0.28, C II emission is detected in alpha Aql (B-V = 0.22). The dropoff in emission is inconsistent with models of the mechanically generated acoustic flux available. It is concluded that, although the nonmagnetic basal heating is an increasingly important source of atmospheric heating among the early F stars, magnetic heating occurs in any star which has a sufficiently thick convective zone to generate acoustic heating.

12015 (ESA-SP—281-VOL-1, pp 331-334) **Lithium and chromospherically active single giants.** Fekel, F.C. Jun 1988. NTIS, PC A19/MF A01; ESA Publications Div., ESTEC, Noordwijk, Netherlands, 140 Dutch guilders. (ETN—88-93155; CONF-8804199—).

From A decade of UV astronomy with the IUE satellite; Greenbelt, MD, USA (1 Apr 1988).

Nine chromospherically active single K giants were identified from surveys of chromospherically active stars. The stars have v sin i's ranging from 6 to 46 km/sec. Such large velocities are not explained by scenarios of main sequence to giant star evolution. Fluxes of the ultraviolet emission lines of these stars are substantially less than those of FK Comae. Many of these giants have a moderate or strong lithium line strongly suggesting that these stars recently evolved from rapidly rotating A or early F stars as is suggested by their space motions. Thus, they are not spun down FK Com stars. The characteristics of these stars are such that they may be confused with pre-main sequence stars. The primary difference may be that the post main sequence stars have strong H alpha absorption lines while the pre-main sequence stars appear to have a weak H alpha absorption line or possibly H alpha in emission above the continuum.

12016 (ESA-SP—281-VOL-1, pp 335-338) **Mg II flux and profile variability of hybrid-chromosphere stars.** Veale, A.; Brown, A. Jun 1988. NTIS, PC A19/MF A01; ESA Publications Div., ESTEC, Noordwijk, Netherlands, 140 Dutch guilders. (ETN—88-93155; CONF-8804199—).

From A decade of UV astronomy with the IUE satellite; Greenbelt, MD, USA (1 Apr 1988).

Results from an IUE investigation of the variability seen in the Mg II emission line fluxes and wind absorption components of hybrid-chromosphere stars are presented. Real Mg II flux variability is shown with most of the variation being long-term. This variability appears to be due to global changes in the Mg II surface activity. Major changes in the wind absorption component are not seen.

12017 (ESA-SP—281-VOL-1, pp 339-342) **Discovery of a co-rotating magnetosphere in a helium weak star: HD5737 = alpha Scl.** Shore, S.N.; Brown, D.N.; Sonneborn, G. (Computer Sciences Corp., Greenbelt, MD (USA)). Jun 1988. NTIS, PC A19/MF A01; ESA Publications Div., ESTEC, Noordwijk, Netherlands, 140 Dutch guilders. (ETN—88-93155; CONF-8804199—).

From A decade of UV astronomy with the IUE satellite; Greenbelt, MD, USA (1 Apr 1988).

The discovery, using combined IUE spectroscopy and Zeeman polarimetric magnetic field measurements, of a magnetosphere in a helium weak star is reported. The star, HD 5737 = alpha Scl, is one of the extreme He weak stars in its He deficiency, but is otherwise quite similar to the other sn stars HD 21699 and HD 79158. A period for the magnetic and C IV and Si IV variations of 21.65 days, a factor of 10 longer than the other variable sn stars is indicated. The effective (longitudinal) field nulls correspond extremely well to C IV line strength maxima. The magnetic field and equatorial magnetosphere are highly oblique (70 deg) and the line variations appear to be stable.

12018 (ESA-SP—281-VOL-1, pp 343-346) **Observations of ultraviolet variability in RV Tauri stars.** Brugel, E.W.; Cardelli, J.A. Jun 1988. NTIS, PC A19/MF A01; ESA Publications Div., ESTEC, Noordwijk, Netherlands, 140 Dutch guilders. (ETN—88-93155; CONF-8804199—).

From A decade of UV astronomy with the IUE satellite; Greenbelt, MD, USA (1 Apr 1988).

An IUE program to monitor the ultraviolet variability in RV Tauri stars was initiated. The Mg II region was investigated as a potential probe of atmospheric shocks, which are believed to be associated with the pulsational variability of this class of objects. Observations, a description of the spectra, and findings for V Vul and AC Her are presented. The Mg II emission does vary significantly during the cycle; major changes in the emission line strength occur on a time scale much less than 0.2 in phase; and as the UV (and optical) continuum flux increases, the Mg II lines decrease and increased emission may be seen at 2823, 2844, and 2900 A.

12019 (ESA-SP—281-VOL-1, pp 349-356) **Fluorescence processes and line identifications in the UV spectra of cool stars.** Carpenter, K.G.; Johansson, S. Jun 1988. NTIS, PC A19/MF A01; ESA Publications Div., ESTEC, Noordwijk, Netherlands, 140 Dutch guilders. (ETN—88-93155; CONF-8804199—).

From A decade of UV astronomy with the IUE satellite; Greenbelt, MD, USA (1 Apr 1988).

Fluorescence processes active in the outer atmospheres of noncoronal cool stars and the UV lines they produce are summarized. Eight pumping processes and 21 fluorescent line products are discussed. The processes, which produce 12 lines, involves energy levels not previously known to be radiatively populated. Four of these are examples of self-fluorescence, whereby one or more lines of Fe II photo-excite through coincident lines the upper levels of other Fe II lines lines seen in emission, while two others explain the selective excitation of solitary Ni II and Si I lines. Nine of the line products are decays from levels in Fe I and Fe II already known to be radiatively populated.

12020 (ESA-SP—281-VOL-1, pp 361-363) **Identification of new fluorescence processes in the UV spectra of cool stars from new energy levels of Fe II and Cr II.** Johansson, S.; Carpenter, K.G. (Colorado Univ., Boulder (USA)). Jun 1988. NTIS, PC A19/MF A01; ESA Publications Div., ESTEC, Noordwijk, Netherlands, 140 Dutch guilders. (ETN—88-93155; CONF-8804199—).

From A decade of UV astronomy with the IUE satellite; Greenbelt, MD, USA (1 Apr 1988).

Two fluorescence processes operating in atmospheres of cool stars, symbiotic stars, and the Sun are presented. Two emission lines, at 1347.03 and 1360.17 A, are identified as fluorescence lines of Cr II and Fe II. The lines are due to transitions from highly excited levels, which are populated radiatively by the hydrogen Lyman alpha line due to accidental wavelength coincidences. Three energy levels, one in Cr II and two in Fe II, are reported.

12021 (ESA-SP—281-VOL-1, pp 365-368) **Periodic modulation of the atmosphere of Alpha Orionis.** Dupree, A.K.; Baliunas, S.L.; Guinan, E.F.; Hartmann, L.; Nassiopoulos, G.E.; Sonneborn, G. (Harvard-Smithsonian Center for Astrophysics, Cambridge, MA (USA)). Jun 1988. NTIS, PC A19/MF A01; ESA Publications Div., ESTEC, Noordwijk, Netherlands, 140 Dutch guilders. (ETN—88-93155; CONF-8804199—).

From A decade of UV astronomy with the IUE satellite; Greenbelt, MD, USA (1 Apr 1988).

Alpha Orionis (Betelgeuse; M2 Iab) was monitored with IUE since 1984. Discovery of a 420-day periodic modulation of the flux in the optical and ultraviolet continua, and in the Mg II h and k line emission cores suggests that periodic photospheric pulsations were present from 1984 to 1986. This behavior continues through 1987. However, the general flux level of the ultraviolet continuum and the Mg II lines is decreasing, and the amplitude of the variation may be reduced. These decreases may be the emerging signature of an additional longer period. The density sensitive C II diagnostic, 2325.4/2328.1, indicates the chromospheric densities range between log N(sub e) (cm-3) = 8.7 and 9.5, but periodicities are not evident.

12022 (ESA-SP—281-VOL-1, pp 369-372) **Mg II line profiles of the Mira S Carinae.** Brugel, E.W.; Bookbinder, J.A.; Brown, A. (Joint Inst. for Lab. Astrophysics, Boulder, CO (USA)). Jun 1988. NTIS, PC A19/MF A01; ESA Publications Div., ESTEC, Noordwijk, Netherlands, 140 Dutch guilders. (ETN—88-93155; CONF-8804199—).

From A decade of UV astronomy with the IUE satellite; Greenbelt, MD, USA (1 Apr 1988).

High-dispersion IUE observations obtained to investigate the evolution of the shock structure of the Mira S Carinae (S Car) produced, despite very limited phase coverage, a set of five spectra of the Mg II h and k lines. There is significant emission from both the h and k lines at velocities of -150 km/sec relative to the stellar photosphere. The h-to-k ratio of the Mg II doublet remains below the theoretically predicated values of 2:1 to 1:1, and shows a smooth dependence on the optical phase. Archival studies of other Miras (e.g., R Car) indicate that S Car is not unique in possessing unusual and highly variable Mg II h and k line profiles.

12023 (ESA-SP—281-VOL-1, pp 381-384) **Carbon and nitrogen abundance determinations from transition layer lines.** Boehm-Vitense, E.; Mena-Werth, J. Jun 1988. NTIS, PC A19/MF A01; ESA Publications Div., ESTEC, Noordwijk, Netherlands, 140 Dutch guilders. (ETN—88-93155; CONF-8804199—).

From A decade of UV astronomy with the IUE satellite; Greenbelt, MD, USA (1 Apr 1988).

For red giants a smooth increase in the nitrogen to carbon abundance ratio for increasing B-V as is expected for the first dredge up phase when the outer convection zone deepens is found. An average increase in the nitrogen to silicon ratio for B-V = 0.6, which goes back to almost solar values for cool giants with B - V approximately 1.0, is reported. It looks as if Si would be enriched for deeper mixing contrary to expectations from standard evolution theory.

12024 (ESA-SP—281-VOL-1, pp 385-388) **Anomalous C 4 intensity ratio in symbiotic stars.** Michalitsianos, A.G.; Kafatos, M.; Fahey, R.P. (George Mason Univ., Fairfax, VA (USA)). Jun 1988. NTIS, PC A19/MF A01; ESA Publications Div., ESTEC, Noordwijk, Netherlands, 140 Dutch guilders. (ETN—88-93155; CONF-8804199—).

From A decade of UV astronomy with the IUE satellite; Greenbelt, MD, USA (1 Apr 1988).

The C IV lambda lambda 1548.2,1550.8 resonance doublet in a symbiotic stars was shown to exhibit anomalous line intensity ratios in which I (lambda 1548.2)/I(lambda 1550.8) less than 1, or less than the optically-thick limit of unity. The R Aquarii-central HII region and RX Puppis exhibit this phenomena. The I(lambda 1548.2)/I(lambda 1550.8) ratio in RX Puppis is found to vary inversely with the total C IV line intensity, and with the FES-visual light, as the object declined over a 5 yr period following a brightening in UV and optical emission which peaked in 1982. This doublet intensity behavior could be explained by a wind which has a narrow velocity range of 600 approx. less than sup v wind approx. less than 1000 km/sec, or by the pumping of the Fe II (mul. 45.01) transition a sup 4 F/sub 9/2 - y sup 4 H(o)/sub 11/2 by C IV lambda 1548.2, which effectively scatters C IV photons into the Fe II spectrum in these objects.

12025 (ESA-SP—281-VOL-1, pp 393-396) **UV silicon spectra of early B stars.** Massa, D. Jun 1988. NTIS, PC A19/MF A01; ESA Publications Div., ESTEC, Noordwijk, Netherlands, 140 Dutch guilders. (ETN—88-93155; CONF-8804199—).

From A decade of UV astronomy with the IUE satellite; Greenbelt, MD, USA (1 Apr 1988).

The UV silicon spectra of mid to early B stars are examined and compared to models. It is found that lines are extremely sensitive to stellar temperature and luminosity. Although the models fail to predict the quantitative behavior of the line strengths, they do, in most instances, describe their qualitative behavior.

12026 (ESA-SP—281-VOL-1, pp 397-400) **C IV and Si IV in IUE spectra of normal B8-A0 stars: UV identified Be/Ae stars.** Chiu, W.A.; Grady, C.A.; Bruhweiler, F.C. (Catholic Univ. of America, Washington, DC (USA)). Jun 1988. NTIS, PC A19/MF A01; ESA Publications Div., ESTEC, Noordwijk, Netherlands, 140 Dutch guilders. (ETN—88-93155; CONF-8804199—).

From A decade of UV astronomy with the IUE satellite; Greenbelt, MD, USA (1 Apr 1988).

Archival IUE high dispersion spectra of 42 B6-A2 stars within 200 pc were surveyed. Five of the program stars show significant C IV and Si IV absorption. All of the stars with detected C IV have v sin i less than or = 190 km/sec. Sharp absorption cores are present in Si II lambda 1533 in 3 of the objects, indicating that these are previously unrecognized shell stars. Three of the stars have variable or asymmetric C IV profiles which are consistent with the C IV and Si IV being produced in stellar winds. One star has C IV in the form of a shortward-shifted discrete absorption component, similar to those observed in Be stars. The data are compared with similar data for Be and B shell stars.

12027 (ESA-SP—281-VOL-1, pp 401-404) **Ultraviolet properties of IRAS-selected Be stars.** Bjorkman, K.S.; Snow, T.P. Jun 1988. NTIS, PC A19/MF A01; ESA Publications Div., ESTEC, Noordwijk, Netherlands, 140 Dutch guilders. (ETN—88-93155; CONF-8804199—).

From A decade of UV astronomy with the IUE satellite; Greenbelt, MD, USA (1 Apr 1988).

New IUE observations were obtained of 35 Be stars from a list of stars which show excess infrared fluxes in IRAS data. The IRAS-selected Be stars show larger C IV and Si IV equivalent widths than other Be stars. Excess C IV and Si IV absorption seems to be independent of spectral type for IRAS-selected Be stars later than spectral type B4. This is interpreted as evidence for a possible second mechanism acting in conjunction with radiation pressure for producing the winds in Be stars. No clear correlation of IR excess of v sin i with C IV or Si IV equivalent widths is seen, although a threshold for the occurrence of excess C IV and Si IV absorption appears at a v sin i of 150 km/sec.

12028 (ESA-SP—281-VOL-1, pp 417-420) **Galatic and LMC extreme line supergiants compared: IUE observations of the Henize-Carlson and Zoo star samples of massive supergiants.** Shore, S.N.; Sanduleak, N.; Brown, D.N.; Sonneborn, G.; Bopp, B.W.; Robinson, C.R. (Toledo Univ., OH (USA)). Jun 1988. NTIS, PC A19/MF A01; ESA Publications Div., ESTEC, Noordwijk, Netherlands, 140 Dutch guilders. (ETN—88-93155; CONF-8804199—).

From A decade of UV astronomy with the IUE satellite; Greenbelt, MD, USA (1 Apr 1988).

The Henize-Carlson sample of galactic massive supergiants, and a comparison between the Galactic and LMC samples are discussed. Several of the stars, notably He3-395 and S 127/LMC, have very similar shell characteristics. There appears to be little difference, other than luminosity, between the LMC and Galactic samples. One star, He3-1482, was detected with the Very Large Array at 6 cm. The UV data is combined with IRAS and optical information.

12029 (ESA-SP—281-VOL-1, pp 423-424) **Mass loss from the K dwarf in V471 Tauri.** Mullan, D.J.; Bruhweiler, F.; Sion, E.M. (Villanova Univ., PA (USA)). Jun 1988. NTIS, PC A19/MF A01; ESA Publications Div., ESTEC, Noordwijk, Netherlands, 140 Dutch guilders. (ETN—88-93155; CONF-8804199—).

From A decade of UV astronomy with the IUE satellite; Greenbelt, MD, USA (1 Apr 1988).

Spectra of Mg II h and k were obtained for V471 Tau at phases zero (K dwarf in front) and 0.5 (white dwarf in front). At phase zero, strong blueshifted absorption is present, suggestive of a wind from the K dwarf with terminal velocity 600 to 400 km/sec and mass loss rate at least 3 orders of magnitude greater than solar. Discrete blue-shifted absorption features occur at velocities of 200 and 500 km/sec. At phase 0.5, the blueshifted absorption is much weaker, although still detectable.

12030 (ESA-SP—283, pp 205-209) **Next decades of space astronomy.** Harwit, M. May 1988. NTIS, PC A10/MF A01. (ETN—88-93157; CONF-8707206—).

From Space science and fundamental physics; Alpbach, Austria (28 Jul 1987).

Instrument capabilities, information sources, the history, and epistemology of space astronomy are reviewed.

12031 **(KEK—87-19) Proceedings of the ASTROMAG workshop.** Nishimura, Jun; Nakamura, Kenzo; Yamamoto, Akira (eds.). (National Lab. for High Energy Physics, Oho, Ibaraki (Japan)). Oct 1987. 88-105p. (CONF-8707191—). NTIS (US Sales Only), PC A08/MF A01. Order Number DE88780144/JAW.

From ASTROMAG workshop; Oho, Japan (9 Jul 1987).

Individual papers in these proceedings are indexed separately. (LEW)

12032 **(N—88-29654) MEVTV workshop on nature and composition of surface units on Mars.** Zimbelman, J.R.; Solomon, S.C.; Sharpton, V.L. (Lunar and Planetary Inst., Houston, TX (USA)). 1987. 148p. (NASA-CR—183075; NAS—1.26:183075; LPI-CONTRIB—88-05; CONF-8712129—). NTIS, PC A07/MF A01.

From MEVTV workshop on nature and composition of surface units on Mars; Napa, CA, USA (4 Dec 1987).

Topics addressed include: SNC meteorites and their potential for providing information about the geochemical evolution of Mars; remote sensing; photogeological inferences of Martian surface compositions; and interactions of the surface with volatiles in either the surface or the atmosphere.

12033 (N—88-29654, pp 17-19) **Review: Quantitative models for lava flows on Mars.** Baloga, S.M. 1987. NTIS, PC A07/MF A01. (NASA-CR—183075; NAS—1.26:183075; LPI-CONTRIB—88-05; CONF-8712129—).

From MEVTV workshop on nature and composition of surface units on Mars; Napa, CA, USA (4 Dec 1987).

The purpose of this abstract is to review and assess the application of quantitative models (Gratz numerical correlation model, radiative loss model, yield stress model, surface structure model, and kinematic wave model) of lava flows on Mars. These theoretical models were applied to Martian flow data to aid in establishing the composition of the lava or to determine other eruption conditions such as eruption rate or duration.

12034 (N—88-29654, pp 20-21) **History of Martian volcanism determined from a revised relative chronology.** Barlow, N.G. 1987. NTIS, PC A07/MF A01. (NASA-CR—183075; NAS—1.26:183075; LPI-CONTRIB—88-05; CONF-8712129—).

From MEVTV workshop on nature and composition of surface units on Mars; Napa, CA, USA (4 Dec 1987).

The Mariner 9 and Viking images of the Martian surface revealed much evidence of volcanic activity, both from early in the planet's history and more recently. The morphology of volcanic features range from plains to a variety of constructs, known as paterae, tholii (domes), and mons (shields) calculation of the density of superposed impact craters allows determination of the ages of these features relative to each other and to other geomorphic features on the planet's surface. The relative plotting technique recently was used to revise the Martian relative chronology.

12035 (N—88-29654, pp 22-24) **Mars: Near-infrared comparative spectroscopy during the 1986 opposition.** Bell, J.F. III; McCord, T.B. 1987. NTIS, PC A07/MF A01. (NASA-CR—183075; NAS—1.26:183075; LPI-CONTRIB—88-05; CONF-8712129—).

From MEVTV workshop on nature and composition of surface units on Mars; Napa, CA, USA (4 Dec 1987).

Near-infrared spectral observations of Mars during the 1986 opposition were performed at the Mauna Kea Observatory utilizing the University of Hawaii's 88 inch telescope. Spectra were obtained of several Martian locations using a continuously variable filter (CVF) spectrometer with a resolution of 1.25 percent. Spot-to-spot ratios were produced between spectra taken in different geological regions.

12036 (N—88-29654, pp 31-33) **Intercrater plains deposits and the origin of Martian valleys.** Brakenridge, G.R. 1987. NTIS, PC A07/MF A01. (NASA-CR—183075; NAS—1.26:183075; LPI-CONTRIB—88-05; CONF-8712129—).

From MEVTV workshop on nature and composition of surface units on Mars; Napa, CA, USA (4 Dec 1987).

Detailed geological mapping of portions of the Thaumasia Fossae and Aeolis Quandrangles has documented several interesting relationships between valley development and local geology. Formation of the valley development was discussed.

12037 (N—88-29654, pp 34-36) **Weathering of sulfides on Mars.** Burns, R.G.; Fisher, D.S. 1987. NTIS, PC A07/MF A01. (NASA-CR—183075; NAS—1.26:183075; LPI-CONTRIB—88-05; CONF-8712129—).

From MEVTV workshop on nature and composition of surface units on Mars; Napa, CA, USA (4 Dec 1987).

Pyrrhotite-pentlandite assemblages in mafic and ultramafic igneous rocks may have contributed significantly to the chemical weathering reactions that produce degradation products in the Martian regolith. By analogy and terrestrial processes, a model is proposed whereby supergene alteration of these primary Fe-Ni sulfides on Mars has generated secondary sulfides (e.g., pyrite) below the water table and produced acidic groundwater containing high concentrations of dissolved Fe, Ni, and sulfate ions. The low pH solutions also initiated weathering reactions of igneous feldspars and ferromagnesian silicates to form clay silicate and ferric oxyhydroxide phases. Near-surface oxidation and hydrolysis of ferric sulfato- and hydroxo-complex ions and sols formed gossan above the water table consisting of poorly crystalline hydrated ferric sulfates (e.g., jarosite), oxides (ferrihydrite, goethite), and silica (opal). Underlying groundwater, now permafrost contains hydroxo sulfato complexes of Fe, Al, Mg, Ni, which may be stabilized in frozen acidic solutions beneath the surface of Mars. Sublimation of permafrost may replenish colloidal ferric oxides, sulfates, and phyllosilicates during dust storms on Mars.

12038 (N—88-29654, pp 37-39) **Mapping of volcanic units at Alba Patera, Mars.** Cattermole, P. 1987. NTIS, PC A07/MF A01. (NASA-CR—183075; NAS—1.26:183075; LPI-CONTRIB—88-05; CONF-8712129—).

From MEVTV workshop on nature and composition of surface units on Mars; Napa, CA, USA (4 Dec 1987).

Detailed photogeologic mapping of Alba Patera, Northern Tharsis, was completed and a geologic map prepared. This was supplemented by a series of detailed volcanic flow maps and used to study the morphometry of different flow types and analyze the way in which the behavior of the volcano has changed with time and also the manner in which flow fields developed in different sectors of the structure.

12039 (N—88-29654, pp 46-48) **Chemical and spectroscopic characterization of a suite of Mars soil analogs.** Coyne, L.M.; Banin, A.; Orenberg, J.B.; Carle, G.C.; Chang, S.; Scattergood, T.W. (State Univ. of New York, Stony Brook (USA)). 1987. NTIS, PC A07/MF A01. (NASA-CR—183075; NAS—1.26:183075; LPI-CONTRIB—88-05; CONF-8712129—).

From MEVTV workshop on nature and composition of surface units on Mars; Napa, CA, USA (4 Dec 1987).

The National Aeronautics and Space Administration has begun preparations for the flight of the Mars Observer Mission in the early 1990s. An advanced ground-based study is being conducted on a usefully limited suite of Mars Soil Analog Materials (MarSAM) intended to simulate the aeolian material covering the surface of Mars. A series of variably proportioned iron/calcium smectite clays were prepared from a typical montmorillonite clay using the Banin method. The effect of increasing iron on a diverse set of chemical and spectroscopic properties of the suite of clays is discussed. In order to chemically characterize the MarSAM and compare them with the Martian soil studied by Viking, the clays were analyzed for their major and minor elemental compositions by X-ray fluorescence and ion-coupled plasma techniques. It was concluded that the surface iron has a complex and hitherto uninvestigated impact on the catalytic and spectroscopic properties of clays and on the ability of these material to store energy.

12040 (N—88-29654, pp 49-50) **Small Martian valcanoes.** Davis, P.A.; Tanaka, K.L. 1987. NTIS, PC A07/MF A01. (NASA-CR—183075; NAS—1.26:183075; LPI-CONTRIB—88-05; CONF-8712129—).

From MEVTV workshop on nature and composition of surface units on Mars; Napa, CA, USA (4 Dec 1987).

Various types of volcanoes were identified on Mars, mainly on the basis of qualitative morphologic criteria such as relief, circularity, summit craters, and alignment with structural trends. A survey of Viking Orbiter images is being conducted to identify possible candidates for Martian volcanoes. The topographic profiles of the selected Martian volcanoes that are currently being acquired will be compared with tabulated data for terrestrial and lunar volcanoes. Variation in volcanic style with age will also be examined.

12041 (N—88-29654, pp 51-53) **Martian sedimentary record.** Dehon, R.A. 1987. NTIS, PC A07/MF A01. (NASA-CR—183075; NAS—1.26:183075; LPI-CONTRIB—88-05; CONF-8712129—).

From MEVTV workshop on nature and composition of surface units on Mars; Napa, CA, USA (4 Dec 1987).

The differences between the surface geology of Mars and earth are discussed. Sedimentary processes and fluvial systems on Mars are examined. Surface mapping reveals the more recent depostional patterns. In future missions, radar sounding, active seismic systems, and on site deep drilling may be required to fully document the depositional history. For the present, identification of sedimentary layers must rest on localities of tectonic or erosional windows, detection of buried surfaces by indirect methods, and deposition or off lap patterns of distribution.

12042 (N—88-29654, pp 54-56) **Progress in determining the thickness and distribution of volcanic materials on Mars.** Dehon, R.A. 1987. NTIS, PC A07/MF A01. (NASA-CR—183075; NAS—1.26:183075; LPI-CONTRIB—88-05; CONF-8712129—).

From MEVTV workshop on nature and composition of surface units on Mars; Napa, CA, USA (4 Dec 1987).

Volcanic plains and constructs comprise over half the surface of Mars. Volume estimates require sensible estimates of the thickness of volcanic materials. The completion of the 1:2 M Viking photomosaics and a refined geologic map based on Viking photography set the stage for improved thickness studies and volume estimates. Currently, a revised (but incomplete) data base of 740 partially buried craters was compiled using Mars photomosaics at 1:2 M for initial identification and measurement.

12043 (N—88-29654, pp 57-59) **Gamma-ray/neutron spectroscopy from the Mars observer.** Englert, P.; Reedy, R.C.; Drake, D.M.; Feldman, W.C.; Squyres, S.W.; Evans, L.G.; Boynton, W.V. (Arizona Univ., Tucson (USA)). 1987. NTIS, PC A07/MF A01. (NASA-CR—183075; NAS—1.26:183075; LPI-CONTRIB—88-05; CONF-8712129—).

From MEVTV workshop on nature and composition of surface units on Mars; Napa, CA, USA (4 Dec 1987).

The Gamma-Ray Spectrometer (GRS) experiment on Mars Observer will measure gamma rays and neutrons that escape from Mars. The intensities of gamma-ray lines and of the thermal and epithermal neutrons can be used to study many problems related to Martian volcanism and volatiles. The results of theoretical calculations for the production and transport of gamma rays and neutrons indicate that the GRS should be able to determine the abundances of many elements and the amounts and stratigraphy of H2O and CO2 on and in the top meter of the Martian surface. Design considerations of the GRS are discussed.

12044 (N—88-29654, pp 60-61) **Variability in spectral signatures of terrestrial volcanic rocks and implications for volcanology on Mars.** Francis, P.W. 1987. NTIS, PC A07/MF A01. (NASA-CR—183075; NAS—1.26:183075; LPI-CONTRIB—88-05; CONF-8712129—).

From MEVTV workshop on nature and composition of surface units on Mars; Napa, CA, USA (4 Dec 1987).

The LANDSAT Thematic Mapper (TM) studies of 2.2 my old ignimbrites in a test area around the Cerro Galan Caldera, N. W. Argentina, show that the ignimbrites exhibit a remarkable range of spectral characteristics dependent both on intrinsic and extrinsic properties resulting from aeolian weathering processes. Spectral profiles of the ignimbrite in four contrasted environments were constructed using 6 TM bands. The textural and structural characteristics of ignimbrites on Mars were evaluated.

12045 (N—88-29654, pp 67-68) **Photogeological inferences of Martian surface composition.** Greeley, R. 1987. NTIS, PC A07/MF A01. (NASA-CR—183075; NAS—1.26:183075; LPI-CONTRIB—88-05; CONF-8712129—).

From MEVTV workshop on nature and composition of surface units on Mars; Napa, CA, USA (4 Dec 1987).

Photogeological mapping provides a systematic documentation of geologic observations and included the identification of surface materials and structures, and determination of their sequence of formation. It is concluded that photogeologic mapping shows the presence of a wide range of materials on Mars. Many of which appear to be volcanic. The knowledge of the composition of these materials is poorly constrained. Inferences drawn from the morphology of individual flows would suggest that most of the materials had rheological properties similar to basalt or other mafic magmas.

12046 (N—88-29654, pp 69-71) **Lava flow-field morphology: a case study from Mount Etna, Sicily.** Guest, J.E.; Hughes, J.W.; Duncan, A.M. (Luton College of Higher Education (England)). 1987. NTIS, PC A07/MF A01. (NASA-CR—183075; NAS—1.26:183075; LPI-CONTRIB—88-05; CONF-8712129—).

From MEVTV workshop on nature and composition of surface units on Mars; Napa, CA, USA (4 Dec 1987).

The morphology of lava flows is often taken as an indicator of the broad chemical composition of the lava, especially when interpreting extraterrestrial volcanoes using spacecraft images. The historical lavas of the active volcano Mount Etna in Sicily provide an excellent opportunity to examine the controls on flow field mor-

phology. In this study only flow produced by flank eruptions after the middle of the 18th century are examined. The final form of a flow-field may be more indicative of the internal plumbing of the volcano, which may control such factors as the effusion, rate, duration of eruption, volume of available magma, rate of de-gassing, and lava rheology. Different flow morphologies on Etna appear to be a good indicator of differing conditions within the volcanic pile. Thus the spatial distribution of different flow types on an extraterrestrial volcano may provide useful information about the plumbing conditions of that volcano, rather than necessarily providing information on the composition of materials erupted.

12047 (N—88-29654, pp 74-75) **Some probable characteristics of the Martian regolith.** King, E.A. 1987. NTIS, PC A07/MF A01. (NASA-CR—183075; NAS—1.26:183075; LPI-CONTRIB—88-05; CONF-8712129—).

From MEVTV workshop on nature and composition of surface units on Mars; Napa, CA, USA (4 Dec 1987).

A number of Mars surface environmental factors seriously affect the properties of the Martian regolith. The result is a regolith that is rather different from that of the moon. Some of the anticipated differences are discussed: weathering and lack of old glass; desert varnish; lack of micrometeorite impact products; abundance of meteorite fragments; and different grain size characteristics.

12048 (N—88-29654, pp 76-78) **What SNC meteorites tell us about Martian magmatism.** Longhi, J.; Pan, V. 1987. NTIS, PC A07/MF A01. (NASA-CR—183075; NAS—1.26:183075; LPI-CONTRIB—88-05; CONF-8712129—).

From MEVTV workshop on nature and composition of surface units on Mars; Napa, CA, USA (4 Dec 1987).

The SNC meteorites record relatively recent (less than b.y.) basaltic volcanism on a hydrous planet with a core. This much was known about Mars even before the Viking mission. The SNCs tell that the basalts were unusually low in Al2O3 and, despite overall similarities in major elements, apparently sampled two isotopically distinct regions of Mars: one is relatively depleted in incompatible elements (Nahklite source) with a U-Pb model age of 4.3 b.y. and is probably a portion of the upper Martian mantle, whereas the other is relatively enriched in incompatible elements (Shergottite source) with a 4.5 b.y. U-Pb age and is probably Martian crust assimulated into the mantle-derived Shergottite magma. The SNCs tell that the overall abundances of moderately volatile elements, such as alkalies, are higher on Mars than on earth. Given extensive volcanism and a depleted mantle, the present day absence of a thick atmosphere is more likely due to catastrophic removal of a primordial atmosphere than lack of degassing.

12049 (N—88-29654, pp 79-81) **Surface units on Mars: the assemblage in the Valles Marineris.** Lucchitta, B.K. 1987. NTIS, PC A07/MF A01. (NASA-CR—183075; NAS—1.26:183075; LPI-CONTRIB—88-05; CONF-8712129—).

From MEVTV workshop on nature and composition of surface units on Mars; Napa, CA, USA (4 Dec 1987).

The Valles Marineris system of troughs offers a unique opportunity to investigate Martian surface units in the third dimension. The troughs are more than 7 km deep in places and thus expose a significant portion of the Martian upper crust. The geological units within the Valles Marineris can be subdivided into three broad categories: wall rock, interior deposits, and surficial cover. Overall, the exposure units in the Valles Marineris give insights into surface units elsewhere on Mars. The observations tend to support the hypotheses that the highland material is charaged with ice, that some light-colored, rolling, smooth deposits are of volcanic origin, and that dark dunes and streaks are composed of wind blown mafic materials.

12050 (N—88-29654, pp 91-93) **Constraints on the origin of fractured terrane, Northern Martian plains.** Mcgill, G.E. 1987. NTIS, PC A07/MF A01. (NASA-CR—183075; NAS—1.26:183075; LPI-CONTRIB—88-05; CONF-8712129—).

From MEVTV workshop on nature and composition of surface units on Mars; Napa, CA, USA (4 Dec 1987).

The terrane characterized by giant fracture systems that commonly define crudely polygonal patterns has received much attention because of its potential importance to such diverse problems as the amount and distribution of interstitial volatiles on Mars, the source of the northern plains, and the tectonic evolution of the northern plains Problems and constraints on proposed models are examined.

12051 (N—88-29654, pp 94-96) **Viking Landers and remote sensing.** Moore, H.J.; Jakosky, B.M.; Christensen, P.R. (Arizona State Univ., Tempe (USA)). 1987. NTIS, PC A07/MF A01. (NASA-CR—183075; NAS—1.26:183075; LPI-CONTRIB—88-05; CONF-8712129—).

From MEVTV workshop on nature and composition of surface units on Mars; Napa, CA, USA (4 Dec 1987).

Thermal and radar remote sensing signatures of the materials in the lander sample fields can be crudely estimated from evaluations of their physical-mechanical properties, laboratory data on thermal conductivities and dielectric constants, and theory. The estimated thermal inertias and dielectric constants of some of the materials in the sample field are close to modal values estimated from orbital and earth-based observations. This suggests that the mechanical properties of the surface materials of much of Mars will not be significantly different that those of the landing sites.

12052 (N—88-29654, pp 97-99) **Volcano evolution on Mars.** Mouginis-Mark, P.; Wilson, L. 1987. NTIS, PC A07/MF A01. (NASA-CR—183075; NAS—1.26:183075; LPI-CONTRIB—88-05; CONF-8712129—).

From MEVTV workshop on nature and composition of surface units on Mars; Napa, CA, USA (4 Dec 1987).

The diversity of volcanic activity on Mars throughout geologic time was one of the major factors that has controlled the spatial distribution of surface mineralogies. The traditional view of Martian volcanism is one in which effusive activity has dominated the entire preserved geologic history of the planet, with the minor exception of phreatomagnetic activity and associated volcano ground-ice interactions. However, two lines of evidence have caused reconsidering of this view, and have led to the possible role of explosive volcanism on Mars. First, detailed analysis of high resolution Viking Orbiter images has provided good evidence for explosive activity on Hecates Tholus and Alba Patera. Secondly, the problems believed to exist in associating explosive volcanism with silicic magmas on Mars, and the consequent unusual magmatic evolutionary trend for Martian volcanoes from silica-rich to silica-poor, may now be circumvented by the consideration of basatic plinian activity similar in kind to terrestrial eruptions such as the 1886 Tarawera eruption. The morphologic evidence for an early phase of explosive activity on Mars is briefly reviewed, and a model is presented for the emplacement of ash-flow deposits on Martian volcanoes. The volcanoes Alba Patera and Olympus Mons are considered in this context, along with some of the older Martian tholi and paterae

12053 (N—88-29654, pp 101-102) **Episodic vs. epochal release of SO_2 on Mars.** Postawko, S.E.; Fanale, F.P.; Zent, A.P. 1987. NTIS, PC A07/MF A01. (NASA-CR—183075; NAS—1.26:183075; LPI-CONTRIB—88-05; CONF-8712129—).

From MEVTV workshop on nature and composition of surface units on Mars; Napa, CA, USA (4 Dec 1987).

Erosion of the Martian surface by the flow of liquid water has apparently taken place at different times and locations on the planet. Many attempts were made to explain the valley networks by invoking a strong atmospheric CO_2/H_2O greenhouse early in the history of the planet. It was assumed that the large amounts of CO_2 necessary to cause the greenhouse would have disappeared due to carbonate formation. Carbonates have yet to be positively identified. Volcanism has occurred throughout much of the history of Mars. Presumably gases such as SO_2 were released along with CO_2 and H_2O. Estimates of amounts and rates with which SO_2 were released into the Martian atmosphere, and how this would effect the global climate were made. Studies are continuing on the effects of SO_2 and other volcanic gases on Martian climatic history.

12054 (N—88-29654, pp 117-119) **Early cratering rates and the nature of the Martian cratered uplands.** Schultz, P.H. 1987. NTIS, PC A07/MF A01. (NASA-CR—183075; NAS—1.26:183075; LPI-CONTRIB—88-05; CONF-8712129—).

From MEVTV workshop on nature and composition of surface units on Mars; Napa, CA, USA (4 Dec 1987).

The cratered uplands of Mars represent a complex sequence of reworked crater ejecta, distant basin ejecta deposits, sedimentary (aeolian and fluvial) deposits, and possible volcanic plains. The heritage of the early period of impact bombardment is documented in the preserved cratering record where the aereal density of large craters (greater than 20 km) exceeds that of the moon and subtle relicts of large impact basins remain. The cratering record provides a means to estimate the early impact flux on Mars, to constrain the direct and indirect effects of the impact process over various scales, and to evaluate the nature of the cratered upland surface materials. Four issues are addressed: the early Martian cratering rate; the role of late-stage atmospheric accretion of volatiles; the relative effects of craters and basins on the global redistribution of crustal materials; and the indirect longer term effects of basin formation.

12055 (N—88-29654, pp 120-121) **Documenting volcano-tectonic episodes in Mars' stratigraphic record.** Scott, D.H.; Tanaka, K.L. 1987. NTIS, PC A07/MF A01. (NASA-CR—183075; NAS—1.26:183075; LPI-CONTRIB—88-05; CONF-8712129—).

From MEVTV workshop on nature and composition of surface units on Mars; Napa, CA, USA (4 Dec 1987).

Global geologic maps of Mars at 1:15,000,000 scales were digitized to obtain accurate measurements of the areal extent of 90 geologic units. These data were used to determine the resurfacing history of Mars by volcanic, eolian, fluvial, periglacial, and impact processes. This work is presently being extended to focus on the extent, magnitude, and duration of volcanism and tectonism (mainly faulting) throughout each of the three time-stratigraphic systems. This work involves detailed mapping to assess volcano-tectonic episodes in terms of their occurrence in eight epochs that represent subdivisions of Martian periods.

12056 (N—88-29654, pp 127-128) **Crystal fractionation in the SNC meteorites: implications for surface units on Mars.** Treiman, A.H. 1987. NTIS, PC A07/MF A01. (NASA-CR—183075; NAS—1.26:183075; LPI-CONTRIB—88-05; CONF-8712129—).

From MEVTV workshop on nature and composition of surface units on Mars; Napa, CA, USA (4 Dec 1987).

Almost all rock types in the SNC meteorites are cumulates, products of magma differentiation by crystal fractionation (addition or removal of crystals). If the SNC meteorites are from the surface of Mars or near sub-surface, then most of the igneous units on Mars are differentiated. Basaltic units probably experienced minor to moderate differentiation, but ultrabasic units probably experienced extreme differentiation. Products of this differentiation may include Fe-rich gabbro, pyroxenite, peridotite (and thus serpentine), and possibly massive sulfides. The SNC meteorites include ten lithologies (three in EETA79001), eight of which are crystal cumulates. The other lithologies, EETA79001 A and B are subophitic basalts. The cumulate lithologies ALHA77005 and EETA79001 C were not fully described or discussed.

12057 (N—88-30473) **Nineteenth lunar and planetary science conference. Press abstracts.** (Lunar and Planetary Inst., Houston, TX (USA)). 1988. 41p. (NASA-CR—183037; NAS—1.26:183037; LPI-CONTRIB—650; CONF-780314—). NTIS, PC A03/MF A01.

From 9. lunar science conference; Houston, TX, USA (1 Mar 1978).

Topics addressed include: origin of the moon; mineralogy of rocks; CO2 well gases; ureilites; antarctic meteorites; Al-26 decay in a Semarkona chondrule; meteorite impacts on early earth; crystal structure and density of helium; Murchison carbonaceous chondrite composition; greenhouse effect and dinosaurs; Simud-Tiu outflow system of Mars; and lunar radar images.

12058 (N—88-30473, pp 5-7) **Exotic minerals in 3500 million year old rocks: evidence for large meteorite impacts.** Byerly, G.R.; Lowe, D.R.; Asaro, F. (California Univ., Berkeley (USA)). 1988. NTIS, PC A03/MF A01. (NASA-CR—183037; NAS—1.26:183037; LPI-CONTRIB—650; CONF-780314—).

From 9. lunar science conference; Houston, TX, USA (1 Mar 1978).

A relatively small area of mountainous terrain in southern Africa provides scientists from all over the world a look at what the surface of the earth was like three and a half billion years ago. The Barberton Mountains lie astride the borders of the Republic of South Africa, Mozambique, and the Kingdom of Swaziland. The discovery of several widely distributed deposits that were likely formed by major terrestrial impacts of large extraterrestrial bodies during this early period of earth's history is reported. The Barberton impact deposits are being studied by electron microscopy. The impact deposits were examined for minerals that show the effects of shock metamorphism or compositions unusual in terrestrial rocks.

12059 (N—88-30473, pp 8-9) **Non-atmospheric noble gases from CO(sub 2) well gas.** Caffee, M.W.; Hudson, G.B.; Velsko, C.; Alexander, E.C. Jr.; Huss, G.R.; Chivas, A.R. (Australian National Univ., Canberra). 1988. NTIS, PC A03/MF A01. (NASA-CR—183037; NAS—1.26:183037; LPI-CONTRIB—650; CONF-780314—).

From 9. lunar science conference; Houston, TX, USA (1 Mar 1978).

In recent years a number of studies of both terrestrial and extraterrestrial material has allowed the piecing together of a picture of events occurring in the early solar system (4.5 Gyr ago), including the formation of the earth. However, before this picture can be completed with an appropriate amount of detail it will be necessary to make further advances. One of the areas where knowledge is lacking is the chemical and isotopic composition of the earth as a whole. The lack of knowledge has less to do with the capabilities of modern techniques than with the availability of samples to study. About 99.6 percent of the earth's mass is contained in the mantle and core, leaving less that 1 percent in the crust and atmosphere. Although the crust is derived from the mantle it has undergone extensive changes and it is therefore difficult (although not impossible) to use crustal material to study events occurring 4.5 Gyr ago. More information about the early earth could be obtained from studies of the mantle but it is difficult to obtain mantle material, because the mean thickness of the crust is 17 km, much greater than even the deepest mines or drill shafts. The two types of available mantle samples are discussed.

12060 (N—88-30473, pp 10-11) **Ureilites are not igneous differentiates.** Clayton, R.N.; Mayeda, T.K. 1988. NTIS, PC A03/MF A01. (NASA-CR—183037; NAS—1.26:183037; LPI-CONTRIB—650; CONF-780314—).

From 9. lunar science conference; Houston, TX, USA (1 Mar 1978).

Although most all meteorites are as old as the solar system (4.5 billion years), they can be subdivided into primitive and evolved groups, depending on the extent of their chemical and physical processing. Primitive meteorites, most of which are chondrites, are assemblages of dust and millimeter-sized pellets from the presolar nebula, which were not extensively heated and processed since their assembly. Thus they provide information about the conditions in the nebular cloud. Many of the evolved meteorites are achondrites, which are igneous rocks produced by melting on or within an asteroidal object known as the parent body. A major unsolved problem in solar system studies is identification of the source of heat which led to melting of the achondrites. The role of oxygen isotopes in establishing genetic relationships among meteorites is examined.

12061 (N—88-30473, pp 12-13) **New type of primitive meteorite found in Antarcitca.** Grossman, J.N.; Rubin, A.E.; MacPherson, G.J.; Scott, E.R.D.; Weisberg, M.K.; Prinz, M.; Nehru, C.E. (American Museum of Natural History, New York, NY (USA)). 1988. NTIS, PC A03/MF A01. (NASA-CR—183037; NAS—1.26:183037; LPI-CONTRIB—650; CONF-780314—).

From 9. lunar science conference; Houston, TX, USA (1 Mar 1978).

A stony meteorite found in Antarctica in 1985, recently identified as a type of chondrite, probably represents material from a previously unsampled region of the solar system. Scientists are currently debating how the object formed. Preliminary results on Allan Hills 85085 (ALH85085) were presented.

12062 (N—88-30473, pp 14-16) **Evidence of the in situ decay of Al-26 in a Semarkona chondrule.** Hutcheon, I.D.; Hutchison, R.; Wasserburg, G.J. 1988. NTIS, PC A03/MF A01. (NASA-CR—183037; NAS—1.26:183037; LPI-CONTRIB—650; CONF-780314—).

From 9. lunar science conference; Houston, TX, USA (1 Mar 1978).

A long-standing problem in the study of meteorites, with broad implications for the evolution of the solar system, is the source of heat for melting small planets. Meteorites, such as the eucrites, were obviously the result of a melting process on a small planet, yet the decay of the long-lived radionuclides present on the earth, K-40, U-235, U-238, and Th-232, could not have provided nearly enough heat to initiate melting approximately 4.5 aeons ago, even on bodies 1000 km in diameter. This problem addressed by H.C. Urey in 1955, who recognized that the presence of short-lived (and now extinct) radionuclides such as Al-26 (half-life of approximately 720,000 y) in the early solar system would have provided an abundant heat source for melting small asteroid-size bodies. Since any Al-26 initially present in the solar nebula would have completely decayed after only a few tens of millions of years, the problem became one of finding evidence of Al-26, in the form of excess Mg-26, in meteorites. The search for evidence of the Al-26 is briefly examined.

12063 (N—88-30473, pp 17-18) **LSU scientists discover evidence of large meteorite impacts on the early earth.** Lowe, D.R.; Byerly, G.R. 1988. NTIS, PC A03/MF A01. (NASA-CR—183037; NAS—1.26:183037; LPI-CONTRIB—650; CONF-780314—).

From 9. lunar science conference; Houston, TX, USA (1 Mar 1978).

Recent discoveries by scientists at Lousiana State University are examined which may provide a window through which early planetary accretion is viewed and studied, and the role of large meteorite impacts on the evolution of life and the earth's surface in evaluated.

12064 (N—88-30473, pp 19-21) **Crystal structure and density of helium to 232 kbar.** Mao, H.K.; Wu, Y.; Jephcoat, A.P.; Hemley, R.J.; Bell, P.M.; Bassett, W.A. (Cornell Univ., Ithaca, NY (USA)). 1988. NTIS, PC A03/MF A01. (NASA-CR—183037; NAS—1.26:183037; LPI-CONTRIB—650; CONF-780314—).

From 9. lunar science conference; Houston, TX, USA (1 Mar 1978).

The properties of helium and hydrogen at high pressure are topics of great interest to the understanding of planetary interiors. These materials constitute 95 percent of the entire solar system. A technique was presented for the measurement of X-ray diffraction from single-crystals of low-Z condenses gases in a diamond-anvil cell at high pressure. The first such single-crystal X-ray diffraction measurements on solid hydrogen to 26.5 GPa were presented. The application of this technique to the problem of the crystal structure, equation of state, and phase diagram of solid helium is reported. Crucial for X-ray diffraction studies of these materials is the use of a synchrotron radiation source which provides high brillance, narrow collimation of the incident and diffracted X-ray beams to reduce the background noise, and energy-dispersive diffraction techniques with polychromatic (white) radiation, which provides high detection efficiency.

12065 (N—88-30473, pp 22-23) **Lewis Cliff 86010, a unique Antarctic meteorite: possible new clues to the early history of the solar system.** McKay, G.A.; Crozaz, G.; Prinz, M.; Goodrich, C.A.; Delaney, J.S. (Rutgers Univ., New Brunswick, NJ (USA)). 1988. NTIS, PC A03/MF A01. (NASA-CR—183037; NAS—1.26:183037; LPI-CONTRIB—650; CONF-780314—).

From 9. lunar science conference; Houston, TX, USA (1 Mar 1978).

Results form the Antarctic sample, LEW 86010, indicate that it is an extremely interesting meteorite of clear igneous origin, and is probably closely related to ADOR. Several important questions await further detailed study. The most stringent test of the relationship to ADOR will come from the measurement of the oxygen isotopic composition. One possibility proposed is that LEW 86010 represents a partial or total melt of a mixture of material similar to the white Allende clasts and more ordinary chondritic meteorite material. Several lines of investigation will contribute to resolve this question. Further melting studies will be performed to determine whether LEW 86010 represents molten lava. In addition to test the connection with Allende, isotopic studies will look for anomalous isotopic compositions which are ubiquitous in Allende white inclusions. All of these studies will be performed on a tiny sample which weights only 5 grams, and is smaller than a marble, but which contains important clues to events which occurred during the birth of the solar system.

12066 (N—88-30473, pp 25-27) **Noble gases, C,N, and Si isotopes in interstellar SiC form the Murchison carbonaceous chondrite.** Ming, T.; Anders, E.; Zinner, E. (Washington Univ., St. Louis, MO (USA)). 1988. NTIS, PC A03/MF A01. (NASA-CR—183037; NAS—1.26:183037; LPI-CONTRIB—650; CONF-780314—).

From 9. lunar science conference; Houston, TX, USA (1 Mar 1978).

Isotopic measurements of presolar interstellar silicon carbide are presented. Silicon carbide was recently identified in a primitive meteorite Murray. There exists strong evidence that the silicon carbide predates the formation of the solar system and originated in the atmospheres of certain stars. Thus, this material provides a link with its stellar sources and gives the opportunity to study processes taking place in distant stars.

12067 (N—88-30473, pp 31-33) **Debris flows of the Simud-Tiu outflow system of Mars.** Tanaka, K.L. 1988. NTIS, PC A03/MF A01. (NASA-CR—183037; NAS—1.26:183037; LPI-CONTRIB—650; CONF-780314—).

From 9. lunar science conference; Houston, TX, USA (1 Mar 1978).

It is seen that the magnitude of geologic happenings are commonly quite different between the Earth and Mars because of differences in the makeup and breakup of their crusts. By assessing the differences, and the similarities, between planets, the geologic history of Mars can be more fully understood. The identification of debris-flow deposits in channels of Mars, for example, helps to establish which of several competing explanations for the origin of the channels actually occurred. In turn, the Earth is viewed in new, and commonly enlightening perspectives. By the way, it is fortunate that on Earth, thick sequences of impact ejected are not found that could be transformed into the monstrous debris flows that have devastated the Martian surface.

12068 (N—88-30487) **NASA MEVTV program working group meeting: Volcanism on Mars.** (Lunar and Planetary Inst., Houston, TX (USA)). 1988. 33p. (NASA-CR—183074; NAS—1.26:183074; LPI-CONTRIB—660; CONF-8806291—). NTIS, PC A03/MF A01.

From NASA MEVTV program working group meeting: volcanism on Mars; Oahu, HI, USA (27 Jun 1988).

The purpose of this working group meeting is to focus predominantly on volcanism on Mars, prior to considering the more complex issues of interactions between volcanism and tectonism or between volcanism and global or regional volatile evolution. It is also hoped that the topical areas of research identified will aid the planetary geology community in understanding volcanism on Mars and its relationship to other physical processes.

12069 (N—88-30487, pp 1-3) **Eruptive viscosity and volcano morphology.** Posin, S.B.; Greeley, R. 1988. NTIS, PC A03/MF A01. (NASA-CR—183074; NAS—1.26:183074; LPI-CONTRIB—660; CONF-8806291—).

From NASA MEVTV program working group meeting: volcanism on Mars; Oahu, HI, USA (27 Jun 1988).

Terrestrial central volcanoes formed predominantly from lava flows were classified as shields, stratovolcanoes, and domes. Shield volcanoes tend to be large in areal extent, have convex slopes, and are characterized by their resemblance to inverted hellenic war shields. Stratovolcanoes have concave slopes, whereas domes are smaller and have gentle convex slopes near the vent that increase near the perimeter. In addition to these differences in morphology, several other variations were observed. The most important is composition: shield volcanoes tend to be basaltic, stratovolcanoes tend to be andesitic, and domes tend to be dacitic. However, important exceptions include Fuji, Pico, Mayon, Izalco, and Fuego which have stratovolcano morphologies but are composed of basaltic lavas. Similarly, Ribkwo is a Kenyan shield volcano composed of trachyte and Suswa and Kilombe are shields composed of phonolite. These exceptions indicate that eruptive conditions, rather than composition, may be the primary factors that determine volcano morphology. The objective of this study is to determine the relationships, if any, between eruptive conditions (viscosity, erupted volume, and effusion rate) and effusive volcano morphology. Moreover, it is the goal of this study to incorporate these relationships into a model to predict the eruptive conditions of extraterrestrial (Martian) volcanoes based on their morphology.

12070 (N—88-30487, pp 5-7) **Faulting and its relation to volcanism: Mars western equatorial region.** Scott, D.H.; Dohm, J. 1988. NTIS, PC A03/MF A01. (NASA-CR—183074; NAS—1.26:183074; LPI-CONTRIB—660; CONF-8806291—).

From NASA MEVTV program working group meeting: volcanism on Mars; Oahu, HI, USA (27 Jun 1988).

Recently completed geologic maps of Mars show the global distribution of lava flows that were emplaced during each of the three Martian time-stratigraphic periods and the faults and ridges that originated during these periods. These data were extracted from the geologic maps to make a series of volcano-tectonic maps for the Noachian, Hesperian, and Amazonian Periods. The map series is being compiled on Viking photomosaics at 1:15,000,000 scale. These maps will provide a basis for assessing the interactive roles of volcanism and tectonism in the crustal evolution of Mars.

12071 (N—88-30487, pp 13-14) **Mars: Volcanism in the Valles Marineris overlooked.** Lucchitta, B.K. 1988. NTIS, PC A03/MF A01. (NASA-CR—183074; NAS—1.26:183074; LPI-CONTRIB—660; CONF-8806291—).

From NASA MEVTV program working group meeting: volcanism on Mars; Oahu, HI, USA (27 Jun 1988).

Do volcanic rocks exist in the Valles Marineris. This question is pertinent because the Valles Marineris are gigantic grabens, rivaling rift valleys on earth in size and depth. The Valles Marineris were interpreted as extensional tectonic structures, perhaps incipient rifts. On earth, rift valleys commonly contain volcanic deposits. On Mars, deposits inside the Valles Marineris grabens do not have the morphologic signature of such easily identified volcanic features as shield volcanoes or lava flows. Therefore, many researchers have not recognized the deposits inside the Valles Marineris as volcanic. Is Mars, then, different from earth in having formed riftlike grabens unaccompanied by volcanism. Overall, results from the study suggest that volcanism was present in the Valles Marineris; the volcanism was explosive in places; some volcanism was more felsic than that generally assumed elsewhere; and the younger sequence of interior beds was emplaced so late in Martian history that the planet may be considered to be still volcanically active.

12072 (N—88-30487, pp 15-17) **Martian highland paterae: evidence for explosive volcanism on Mars.** Crown, D.A.; Greeley, R. 1988. NTIS, PC A03/MF A01. (NASA-CR—183074; NAS—1.26:183074; LPI-CONTRIB—660; CONF-8806291—).

From NASA MEVTV program working group meeting: volcanism on Mars; Oahu, HI, USA (27 Jun 1988).

The Martian surface exhibits numerous volcanic landforms displaying great diversity in size, age, and morphology. Most research regarding Martian volcanology has centered around effusive basaltic volcanism, including analyses of individual lava flows, extensive lava plains, and large shield volcanoes. These studies were hindered by a lack of definitive morphologic criteria for the remote identification of ash deposits. Knowledge of the abundances, ages, and geologic settings of explosive volcanic deposits on Mars is essential to a comprehensive understanding of the evolution of the Martian surface, with implications for the evolution of the lithosphere and atmosphere as well as the histories of specific volcanic centers and provinces.

12073 (N—88-30487, pp 19-21) **Physical properties of surface materials on Martian volcanoes: dust-covered lava and ash.** Zimbelman, J.R. 1988. NTIS, PC A03/MF A01. (NASA-CR—183074; NAS—1.26:183074; LPI-CONTRIB—660; CONF-8806291—).

From NASA MEVTV program working group meeting: volcanism on Mars; Oahu, HI, USA (27 Jun 1988).

Remote sensing measurements provide information about the Martian surface at scales smaller than can be inferred from imaging data alone. Measurements of Martian volcanoes obtained at visual, infrared, and radar wavelengths are discussed in order to evaluate the physical properties. A related issue involves identifying possible ash deposits by distinctive or anomalous physical characteristics.

12074 (N—88-30487, pp 23-25) **Rifts of deeply eroded Hawaiian basaltic shields: a structural analog for large Martian volcanoes.** Knight, M.D.; Walker, G.P.L.; Mouginis-Mark, P.J.; Rowland, S.K. (Geological Survey, Menlo Park, CA (USA)). 1988. NTIS, PC A03/MF A01. (NASA-CR—183074; NAS—1.26:183074; LPI-CONTRIB—660; CONF-8806291—).

From NASA MEVTV program working group meeting: volcanism on Mars; Oahu, HI, USA (27 Jun 1988).

Recently derived morphologic evidence suggests that intrusive events have not only influenced the growth of young shield volcanoes on Mars but also the distribution of volatiles surrounding these volcanoes: in addition to rift zones and flank eruptions on Arsia Mons and Pavonis Mons, melt water channels were identified to the northwest of Hecates Tholus, to the south of Hadriaca Patera, and to the SE of Olympus Mons. Melt water release could be the surface expression of tectonic deformation of the region or, potentially, intrusive events associated with dike emplacement from each of these volcanoes. In this study the structural properties of Hawaiian shield volcanoes were studied where subaerial erosion has removed a sufficient amount of the surface to enable a direct investigation of the internal structure of the volcanoes. The field investigation of dike morphology and magma flow characteristics for several volcanoes in Hawaii is reported. A comprehensive investigation was made of the Koolau dike complex that passes through the summit caldera. A study of two other dissected Hawaiian volcanoes, namely Waianae and East Molokai, was commenced. The goal is not only to understand the emplacement process and magma flow within these terrestrial dikes, but also to explore the possible role that intrusive events may have played in volcano growth and the distribution of melt water release on Mars.

12075 (N—88-30487, pp 27-29) **Simulations of lava flows on Mars.** Baloga, S.; Crisp, J. 1988. NTIS, PC A03/MF A01. (NASA-CR—183074; NAS—1.26:183074; LPI-CONTRIB—660; CONF-8806291—).

From NASA MEVTV program working group meeting: volcanism on Mars; Oahu, HI, USA (27 Jun 1988).

One way to approach the understanding of the lava flows observed in the Viking images is to use well-documented terrestrial flows and to simulate comparable eruptions adjusted for Martian conditions. The detailed documentation available for several episodes of the 1983 to 1984 PuuOo eruption can be used in combination with an extension of the emplacement theory for solitary lobate flows to simulate comparable eruptions on the surface of Mars. For simplicity, the simulation is restricted to differences in the gravity between earth and Mars.

12076 (N—88-30487, pp 31-32) **Small-scale volcanic landforms indicative of distributary tube systems.** Theilig, E. 1988. NTIS, PC A03/MF A01. (NASA-CR—183074; NAS—1.26:183074; LPI-CONTRIB—660; CONF-8806291—).

From NASA MEVTV program working group meeting: volcanism on Mars; Oahu, HI, USA (27 Jun 1988).

Surface features tens to hundreds of meters in size on Martian lava flows are revealed in high resolution Viking Orbiter images. Many of these morphological features form in response to certain flow emplacement mechanisms, eruptive styles, or rheological properties of the lava. Insight into the relationships between lava flow morphology and the emplacement and characteristics of magma is an ongoing areas of research and allows constraints to be placed on interpretation of Martian volcanism. This report focuses on pressure ridges, tumuli, and pressure plateaus which comprise a suite fo features characteristics of compound pahoehoe lava flows. Similar ridges and mounds were identified in the Tharsis region of Mars.

12077 (N—88-30487, pp 33-35) **Volcanic styles at Alba Patera, Mars: implications of lava flow morphology to the volcanic history.** Schneeberger, D.M.; Pieri, D.C. 1988. NTIS, PC A03/MF A01. (NASA-CR—183074; NAS—1.26:183074; LPI-CONTRIB—660; CONF-8806291—).

From NASA MEVTV program working group meeting: volcanism on Mars; Oahu, HI, USA (27 Jun 1988).

Alba Patera presents styles of volcanism that are unique to Mars. Its very low profile, large areal extent, unusually long and voluminous lava flows, and circumferential graben make it among Mars' most interesting volcanic features. Clues to Alba's volcanic history are preserved in its morphology and stratigraphy. Understanding the relationship of lava flow morphology to emplacement processes should enable estimates of viscosity, effusion rate, and gross composition to be made. Lava flows, with dimensions considered enormous by terrestrial standards, account for a major portion of the exposed surface of Alba Patera. These flows exhibit a range of morphologies. While most previous works have focused on the planimetric characteristics, attention was drawn to the important morphological attributes, paying particular attention to what the features suggest about the emplacement process.

12078 **(N—89-10678) Interplanetary medium data book: Supplement 3A, 1977-1985.** Couzens, D.A.; King, J.H. (National Aeronautics and Space Administration, Greenbelt, MD (USA). Goddard Space Flight Center). Apr 1986. 312p. (NASA-TM—89630; NAS—1.15:89630; NSSDC/WDC-A-RS—86-04A-SUPPL-3A). NTIS, PC A14/MF A01.

Supplement 3 of the Interplanetary Medium Data Book contains a detailed discussion of a data set compilation of hourly averaged interplanetary plasma and magnetic field parameters. The discussion addresses data sources, systematic and random differences, time shifting of ISEE 3 data, and plasma normalizations. Supplement 3 also contains solar rotation plots of field and plasma parameters. Supplement 3A contains computer-generated listings of selected parameters from the composite data set. These parameters are bulk speed (km/sec), density (per cu cm), temperature (in units of 1000 K) and the IMF parameters: average magnitude, latitude and longitude angles of the vector made up of the average GSE components, GSM Cartesian components, and the vector standard deviation. The units of field magnitude, components, and standard deviation are gammas, while the units of field direction angles and degrees.

12079 **(N—89-10780) MECA symposium on Mars: Evolution of its climate and atmosphere.** Baker, V.; Carr, M.; Fanale, F.; Greeley, R.; Haberle, R.; Leovy, C.; Maxwell, T. (Lunar and Planetary Inst., Houston, TX (USA)). 1987. 135p. (NASA-CR—182872; NAS—1.26:182872; LPI-TR—87-01; CONF-8607357—). NTIS, PC A07/MF A01.

From MECA conference on mars: the evolution of its climate and atmosphere; Washington, DC, USA (18 Jul 1986).

The geological, atmospheric, and climatic history of Mars is explored in reviews and reports of recent observational and interpretive investigations. Topics addressed include evidence for a warm wet climate on early Mars, volatiles on Earth and on Mars, CO_2 adsorption on palagonite and its implications for Martian regolith partitioning, and the effect of spatial resolution on interpretations of Martian subsurface volatiles. Consideration is given to high resolution observations of rampart craters, ring furrows in highland terrains, the interannual variability of the south polar cap, telescopic observations of the north polar cap and circumpolar clouds, and dynamical modeling of a planetary wave polar warming mechanism.

12080 (N—89-10780, pp 15-17) **Evidence for glaciation in Elysium.** Anderson, D.M.; Brandstrom, G.W. 1987. NTIS, PC A07/MF A01. (NASA-CR—182872; NAS—1.26:182872; LPI-TR—87-01; CONF-8607357—).

From MECA conference on mars: the evolution of its climate and atmosphere; Washington, DC, USA (18 Jul 1986).

It is suggested that certain landforms in the Elysium region of Mars provide strong evidence for glaciation. Landscapes related to subglacial volcanism suggest that ice was a primary agent in the development of Elysium.

12081 (N—89-10780, pp 23-25) **Mars: a water-rich planet.** Carr, M.H. 1987. NTIS, PC A07/MF A01. (NASA-CR—182872; NAS—1.26:182872; LPI-TR—87-01; CONF-8607357—).

From MECA conference on mars: the evolution of its climate and atmosphere; Washington, DC, USA (18 Jul 1986).

Good geomorphic evidence is presented for a planet that was once water rich, and that a lower limit on the amount of water available for a given Martian watershed may be estimated by assuming that the volume of material eroded was equal to the volume of water available. This estimate, coupled with high latitude water estimates of 50 to 100 m gives a global inventory of about 500 m total water in the subsurface. It was emphasized that this is a lower limit as considerable water may be bound in weathered debris and in primary minerals.

12082 (N—89-10780, pp 26-28) **Martian volcanism: A review.** Carr, M.H. 1987. NTIS, PC A07/MF A01. (NASA-CR—182872; NAS—1.26:182872; LPI-TR—87-01; CONF-8607357—).

From MECA conference on mars: the evolution of its climate and atmosphere; Washington, DC, USA (18 Jul 1986).

Martian volcanism is reviewed. It is emphasized that lava plains constitute the major type of effusive flow, and can be differentiated by morphologic characteristics. Shield volcanoes, domes, and patera constitute the major constructional landforms, and recent work has suggested that explosive activity and resulting pyroclastic deposits may have been involved with formation of some of the small shields. Analysis of morphology, presumed composition, and spectroscopic data all indicate that Martian volcanism was dominantly basaltic in composition.

12083 (N—89-10780, pp 29-31) **Comets, volcanism, the salt rich regolith and cycling of volatiles on Mars.** Clark, B.C. 1987. NTIS, PC A07/MF A01. (NASA-CR—182872; NAS—1.26:182872; LPI-TR—87-01; CONF-8607357—).

From MECA conference on mars: the evolution of its climate and atmosphere; Washington, DC, USA (18 Jul 1986).

The composition of the Martian surface and its evolution are examined, reviewing the results of recent theoretical models and composition estimates based on Viking lander analyses. The data are compiled in tables and characterized in detail, and a high degree of variation among the predictions is noted. The discussion centers on the possible roles of comets (as sources of volatiles), the salt rich regolith (as an important water sink), and volcanic activity (interfering with volatile-recycling processes and eventually producing a volatile depleted surface layer).

12084 (N—89-10780, pp 32-34) **Mars: crustal pore volume, cryospheric depth, and the global occurrence of groundwater.** Clifford, S.M. 1987. NTIS, PC A07/MF A01. (NASA-CR—182872; NAS—1.26:182872; LPI-TR—87-01; CONF-8607357—).

From MECA conference on mars: the evolution of its climate and atmosphere; Washington, DC, USA (18 Jul 1986).

It is argued that most of the Martian hydrosphere resides in a porous outer layer of crust that, based on a lunar analogy, appears to extend to a depth of about 10 km. The total pore volume of this layer is sufficient to store the equivalent of a global ocean of water some 500 to 1500 m deep. Thermal modeling suggests that about 300 to 500 m of water could be stored as ice within the crust. Any excess must exist as groundwater.

12085 (N—89-10780, pp 40-42) **Release of magmatic water on Mars: estimated timing and volumes.** Greeley, R. 1987. NTIS, PC A07/MF A01. (NASA-CR—182872; NAS—1.26:182872; LPI-TR—87-01; CONF-8607357—).

From MECA conference on mars: the evolution of its climate and atmosphere; Washington, DC, USA (18 Jul 1986).

By estimating the total amount of water released by volcanic processes on Mars, the abundance of H_2O at 10 m was estimated. This value was based on mapping volcanic units, estimating thicknesses and volumes, and using a 10 wt. percent value H_2O from terrestrial analogs. By combining such estimates with crater count ages, it is also possible to estimate the timing of water release through Martian history.

12086 (N—89-10780, pp 46) **Interannual variability of global dust storms on Mars.** Haberle, R.M. 1987. NTIS, PC A07/MF A01. (NASA-CR—182872; NAS—1.26:182872; LPI-TR—87-01; CONF-8607357—).

From MECA conference on mars: the evolution of its climate and atmosphere; Washington, DC, USA (18 Jul 1986).

Global dust storms on Mars occur in some years but not in others. In years with global dust storms, dust is raised in the Southern Hemisphere and spread over much of the planet by an intensified Hadley circulation. In years without global dust storms, dust is raised in the Northern Hemisphere by relatively active midlatitude storm systems, but does not spread globally. In both cases the dusty season is winter in the north. It is shown from numerical simulations that a Northern Hemisphere dust haze weakens the intensity of the cross equatorial Hadley circulation and the contribution it makes to the surface stress in the Southern Hemisphere. This, in turn, reduces the possibility of global dust storm development. The interannual variability is the result either of a competition between circulation in opposite hemispheres, in which case the variability has a random component; or it is the result of the cycling of dust between hemispheres, in which case the variability is related to the characteristics of global dust storms themselves.

12087 (N—89-10780, pp 53-56) **Photochemical weathering and contemporary volatile loss on Mars.** Huguenin, R.L. 1987. NTIS, PC A07/MF A01. (NASA-CR—182872; NAS—1.26:182872; LPI-TR—87-01; CONF-8607357—).

From MECA conference on mars: the evolution of its climate and atmosphere; Washington, DC, USA (18 Jul 1986).

In an earlier series of papers by the author it was proposed that photochemical weathering of Fe(2+) in magnetite and in mafic silicates may be occurring in the contemporary surface environment with a resultant loss of O2 from the atmosphere. Morris and Lauer challenged the photochemical weathering model, proposing that oxidation by radiant heating rather than UV photoelectron emission induced oxidation may have dominated in the authors experiments. Subsequent laboratory studies of photochemical weathering of magnetite described here support the authors original proposal that UV illunination can indeed drive the oxidation of magnetite under contemporary Martian surface conditions. The negative results of the Morris and Lauer study can now be explained.

12088 (N—89-10780, pp 64-66) **Climatic effects of enhanced CO_2 levels in Mars early atmosphere.** Kasting, J.F. 1987. NTIS, PC A07/MF A01. (NASA-CR—182872; NAS—1.26:182872; LPI-TR—87-01; CONF-8607357—).

From MECA conference on mars: the evolution of its climate and atmosphere; Washington, DC, USA (18 Jul 1986).

Results are presented of one-dimensional radiation convection modeling of the early Mars atmosphere. Up to 5 bars of CO_2 would have been required to raise the surface temperature (orbitally and globally averaged) above the freezing point, although at the equator at perihelion, 1 bar would have sufficed. Such an atmospheric CO_2 invertory, the author argued, is not inconsistent with any known constraint on Mars' degassed volatile inventory.

12089 (N—89-10780, pp 67-68) **Areal and time distributions of volcanic formations on Mars.** Katterfeld, G.N.; Vityaz, V.A. 1987. NTIS, PC A07/MF A01. (NASA-CR—182872; NAS—1.26:182872; LPI-TR—87-01; CONF-8607357—).

From MECA conference on mars: the evolution of its climate and atmosphere; Washington, DC, USA (18 Jul 1986).

The analysis of igneous rock distribution has been fulfilled on the basis of the geomorphological map of Mars at scale 1:5,000,000, according to data obtained from interpretation of 1:2,000,000 scale pictures of Mariner 9, Mars 4, Mars 5, Viking 1 and 2. Areological areas are listed as having been distinguished as the stratigraphic basis for a martian time scale. The area of volcanic eruptions and the number of eruptive centers are calculated on 10 x 10 deg cells and for each areological eras. The largest area of eruptive happening at different times is related with Tharsis tectonic uplift. The study of distribution of igneous rock area and volcanic centers number on 10 deg sectors and zones revealed the concentration belts of volcanic formations.

12090 (N—89-10780, pp 71-72) **Regional sources and sinks of dust on Mars: Viking observations of Cerberus, Solis Planum, and Syrtis Major.** Lee, S.W. 1987. NTIS, PC A07/MF A01. (NASA-CR—182872; NAS—1.26:182872; LPI-TR—87-01; CONF-8607357—).

From MECA conference on mars: the evolution of its climate and atmosphere; Washington, DC, USA (18 Jul 1986).

A study of seasonal variation of albedo features in the Cerberus, Solis Planum, and Syrtis Major regions was based on Viking Orbiter data obtained over more than one complete Martian year. Contour maps of Lambert albedo and single point thermal inertia were constructed from the Infrared Thermal Mapper experiment data, and Orbiter images were used to determine the pattern and variability of regional winds (inferred from wind streak orientations). Coupled with ground based radar data, these data allow the regional sediment transport direction, surface properties (texture, morphology, and roughness), and the implications of the observed seasonal and longer term dust redistribution to be investigated. Results are outlined.

12091 (N—89-10780, pp 91) **Could icy impacts reconcile Venus with Earth and Mars.** Owen, T. 1987. NTIS, PC A07/MF A01. (NASA-CR—182872; NAS—1.26:182872; LPI-TR—87-01; CONF-8607357—).

From MECA conference on mars: the evolution of its climate and atmosphere; Washington, DC, USA (18 Jul 1986).

The problem of volatile sources in the martian atomosphere was studied. It is suggested that a combination of an impact by an icy planetesimal (radius about 150 km) and solar wind implantation of neon could explain the noble gas abundances on Venus. Early solar wind would supply the right amount of neon with the correct Ne-20/Ne-22 as compared with lunar soils. However, observations of noble gases in a fresh comet are needed to test this hypothesis.

12092 (N—89-10780, pp 92) **Seismic exploration for water on Mars.** Page, T. 1987. NTIS, PC A07/MF A01. (NASA-CR—182872; NAS—1.26:182872; LPI-TR—87-01; CONF-8607357—).

From MECA conference on mars: the evolution of its climate and atmosphere; Washington, DC, USA (18 Jul 1986). .

It is proposed to soft-land three seismometers in the Utopia-Elysium region and three or more radio controlled explosive charges at nearby sites that can be accurately located by an orbiter. Seismic signatures of timed explosions, to be telemetered to the orbiter, will be used to detect present surface layers, including those saturated by volatiles such as water and/or ice. The Viking Landers included seismometers that showed that at present Mars is seismically quiet, and that the mean crustal thickness at the site is about 14 to 18 km. The new seismic landers must be designed to minimize wind vibration noise, and the landing sites selected so that each is well formed on the regolith, not on rock outcrops or in craters. The explosive charges might be mounted on penetrators aimed at nearby smooth areas. They must be equipped with radio emitters for accurate location and radio receivers for timed detonation.

12093 (N—89-10780, pp 93-95) **Thermal properties of Martian surface materials at high lattitudes: possible evidence for permafrost.** Paige, D.A.; Kieffer, H.H. (Geological Survey, Flagstaff, AZ (USA)). 1987. NTIS, PC A07/MF A01. (NASA-CR—182872; NAS—1.26:182872; LPI-TR—87-01; CONF-8607357—).

From MECA conference on mars: the evolution of its climate and atmosphere; Washington, DC, USA (18 Jul 1986).

Evidence is presented from analysis of Viking thermal mapping results that suggests a transition to high thermal inertial material at a depth of approx. 12 cm at +75 deg latitude. This was interpreted as reflecting the transition from ice poor soil to hard frozen permafrost. It was pointed out that such a transition would be expected on the basis of theoretical models of hard frozen permafrost distribution. Although permafrost is not the only plausible martian surface material with high thermal inertia, polar thermal mapping may turn out to be a powerful tool for determining the distribution of permafrost deposits and understanding their behavior. At this point, the circumstantial case for permafrost deposits in the north pole region of Mars is very strong.

12094 (N—89-10780, pp 102-103) **Martian tectonics: a review.** Phillips, R.J. 1987. NTIS, PC A07/MF A01. (NASA-CR—182872; NAS—1.26:182872; LPI-TR—87-01; CONF-8607357—).

From MECA conference on mars: the evolution of its climate and atmosphere; Washington, DC, USA (18 Jul 1986).

It is concluded that Mars was dominated by vertical tectonism more than any of the other terrestrial planets. The structural imprint of the Tharsis and Elysium provinces extends over half the planet, and despite 15 years of debate over the cause of the elevation, volcanic activity, and tectonic style of Tharsis, no uniform theory of Tharsis evolution has been generally agreed upon. Although several theories have been suggested for the origin of the north-south planetary dichotomy, there is also a lack of a testable, plausible model for that major unknown in Mars' evolution.

12095 (N—89-10780, pp 104-105) **Partitioning of carbon dioxide between the atmosphere and lithosphere on early Mars.** Pollack, J.B.; Kasting, J.; Richardson, S. (Iowa State Univ. of Science and Technology, Ames (USA)). 1987. NTIS, PC A07/MF A01. (NASA-CR—182872; NAS—1.26:182872; LPI-TR—87-01; CONF-8607357—).

From MECA conference on mars: the evolution of its climate and atmosphere; Washington, DC, USA (18 Jul 1986).

It is pointed out that in addition to the 1 to 5 bar CO_2 total inventory, a high level of global volcanism was needed to keep the CO_2 from being drawn away permanently by weathering of igneous rocks; the volcanism would continually decompose the carbonate resulting in steady efficient recycling.

12096 (N—89-10780, pp 106-108) **Implications of isotopic signatures of noble gases for the origin and evolution of terrestrial atmospheres.** Rao, A.S.P. 1987. NTIS, PC A07/MF A01. (NASA-CR—182872; NAS—1.26:182872; LPI-TR—87-01; CONF-8607357—).

From MECA conference on mars: the evolution of its climate and atmosphere; Washington, DC, USA (18 Jul 1986).

It is contented that the initial quantities of noble gases present in planetesimals were controlled by the sizes and masses of the planets, and fit with a model of successive accretion. The successive accretion model proposed for the origin of terrestrial planets is based upon: (1) the sequence of zones of condensation of solar nebula, (2) the condensation sequence of minerals, iron and nickel in different P-T regimes of the solar nebula, and (3) the sequence in the nucleation of iron cores of the terrestrial planets.

12097 (N—89-10780, pp 126-128) **Thermal properties of channels in the Aeolis Quadrangle: topographic traps for Aeolian materials.** Zimbelman, J.R. 1987. NTIS, PC A07/MF A01. (NASA-CR—182872; NAS—1.26:182872; LPI-TR—87-01; CONF-8607357—).

From MECA conference on mars: the evolution of its climate and atmosphere; Washington, DC, USA (18 Jul 1986).

Analysis of high spatial resolution (down to 2 to 5 km) thermal data that shows the presence of aeolian debris mantling in topographic traps such as some channels is presented. In cases where this occurs, even if the mantle is thin, it can prevent remote sensing analysis of actual compositional differences that may characterize the true floors of the features.

12098 (N—89-11604) **Cosmic strings and superconducting cosmic strings.** Copeland, E. (Fermi National Accelerator Lab., Batavia, IL (USA)). Aug 1988. 44p. (NASA-CR—183361; NAS—1.26:183361; FERMILAB-PUB—88/108-A; CONF-8805243—). NTIS, PC A03/MF A01.

From 2. Erice summer school on dark matter; Erice, Italy (1 May 1988).

The possible consequences of forming cosmic strings and superconducting cosmic strings in the early universe are discussed. Lecture 1 describes the group theoretic reasons for and the field theoretic reasons why cosmic strings can form in spontaneously broken gauge theories. Lecture 2 discusses the accretion of matter onto string loops, emphasizing the scenario with a cold dark matter dominated universe. In lecture 3 superconducting cosmic strings are discussed, as is a mechanism which leads to the formation of structure from such strings.

12099 **(PB—89-120802/XAB) SESC (Space Environment Services Center) glossary of solar-terrestrial terms (2nd edition).** (Space Environment Services Center, Boulder, CO (USA)). Aug 1988. 74p. NTIS, PC A04/MF A01.

Contents include: Glossary of solar-terrestrial terms; Appendix A: Acronyms and initialisms; Appendix B: Units; Appendix C: Modified zurich (McIntosh) sunspot classification; Appendix D: Bibliography.

12100 **Particle creation in inhomogeneous spacetimes.** Frieman, J.A. (Stanford Linear Accelerator Center, Stanford University, Stanford, California 94309). *Physical Review [Section] D: Particles and Fields;* **39**: No. 2, 389-398(15 Jan 1989).

We study the creation of particles by inhomogeneous perturbations of spatially flat Friedmann-Robertson-Walker cosmologies. For massless scalar fields, the pair-creation probability can be expressed in terms of geometric quantities (curvature invariants). The results suggest that inhomogeneities on scales up to the particle horizon will be damped out near the Planck time. Perturbations on scales larger than the horizon are explicitly shown to yield no created pairs. The results generalize to inhomogeneous spacetimes several earlier studies of pair creation in homogeneous anisotropic cosmologies.

12101 **Mechanism for current generation in strings and internal phase transitions in strings.** Barr, S.M.; Matheson, A.M. (Bartol Research Institute, University of Delaware, Newark, Delaware 19716). *Physical Review [Section] D: Particles and Fields;* **39**: No. 2, 412-419(15 Jan 1989).

We discuss a new mechanism for generating currents in superconducting cosmic strings. If energy is deposited inside a string in the form of the current-carrying fermions then a combination of the inherent directionality of the string (and its zero modes) and CP violation will produce a net nonzero current. Various sources of energy are discussed including the interaction of strings with ambient particles. Another source could be phase transitions which take place inside strings. We discuss such phase transitions at length and briefly discuss other possible consequences of them.

12102 **Properties of the wormhole calculus.** Accetta, F.S.; Chodos, A.; Cooper, F.; Shao, B. (Center for Theoretical Physics, Department of Physics, Yale University, New Haven, Connecticut 06520). *Physical Review [Section] D: Particles and Fields;* **39**: No. 2, 452-461(15 Jan 1989).

We adapt the rules, used by Coleman in the context of Euclidean gravity to show that the cosmological constant vanishes, to the simpler case of a scalar field theory. We compute one- and two-point functions in a variety of examples and in various approximations. We discover cases where wormholes make first-order phase transitions disappear, but permit second-order transitions. We find a peculiar propagator for a scalar field coupled quadratically to wormholes in the Hartree-Fock approximation. We discuss various ways to deal with the divergences caused by arbitrarily large numbers of subuniverses.

12103 **Cosmological helium production simplified.** Bernstein, J.; Brown, L.S.; Feinberg, G. (Department of Physics, Stevens Institute of Technology, Hoboken, New Jersey 07030). *Reviews of Modern Physics;* **61**: No. 1, 25-40(Jan 1989).

The authors present a simplified model of helium synthesis in the early universe. The purpose of the model is to explain clearly the physical ideas relevant to the cosmological helium synthesis in a manner that does not overlay these ideas with complex computer calculations. The model closely follows the standard calculation, except that it neglects the small effect of Fermi-Dirac statistics for the leptons. The temperature difference between photons and neutrinos during the period in which neutrons and protons interconvert is also neglected. These approximations permit the expression of neutron-proton conversion rates in a closed form, which agrees to 10% accuracy or better with the exact rates. Using these analytic expressions for the rates, the authors reduce the calculation of the neutron-proton ratio as a function of temperature to a simple numerical integral. They also estimate the effect of neutron decay on the helium abundance. Their result for this quantity agrees well with precise computer calculations. Their semianalytic formulas are used to determine how the predicted helium abundance varies with such parameters as the neutron lifetime, the baryon-to-photon ratio, the number of neutrino species, and a possible electron-neutrino chemical potential.

12104 **Intrinsic and artificial bias in the KONUS cumulative number distribution.** Jennings, M.C. (California Univ., Riverside (USA); Los Alamos National Lab., NM (USA)). *Astrophysical Journal;* **333**: 700-718(Oct 1988).

The known biases affecting the KONUS gamma burst cumulative number distribution are discussed and categorized as intrinsic (unavoidable) and artificial (avoidable). Artificial biases are removed to obtain a revised, more faithful representation of the true KONUS log N-log Pc, where Pc is in counts (1/0.25 s). A low Pc turnover is still apparent in the revised log N-log Pc. Conflicting claims that the KONUS log N-log Pc is compatible with a nearby disk or an isotropic, homogeneous distribution are tested using the revised log N-log Pc and a rigorous treatment of the KONUS intrinsic gamma background bias. The claims are shown to be improbable. Other possibilities and problems concerning log N-log Pc are discussed, but the need for a complete explanation of the low Pc turnover remains. 71 references.

12105 **Extensive air showers associated with discrete astrophysical sources.** Nagle, D.E.; Gaisser, T.K.; Protheroe, R.J. (Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Annual Review of Nuclear Science;* **38**: No. 1, 609-658(1988).

This review deals with the ultrahigh energy range of gamma-ray astronomy and emphasizes methods for statistical analysis of the data. In addition we devote considerable attention to a description of some scenarios for acceleration of the beams and production of signals. (AIP)

12106 **Detection of cosmic dark matter.** Primack, J.R.; Seckel, D.; Sadoulet, B. (Santa Cruz Institute for Particle Physics, University of California, Santa Cruz, California 95064). *Annual Review of Nuclear Science;* **38**: No. 1, 751-807(1988).

This is a mid-1988 status report on attempts to detect particle dark matter. We have some prejudice in limiting ourselves to dark matter candidates that we feel are especially motivated: weakly interacting massive particles (WIMPs), axions, and light neutrinos. Much of our review centers on the possibility of detecting WIMPs. This is partly because there exist several methods by which WIMPs may be detected in the next decade, whereas for axions the prospects are more uncertain and for light neutrinos essentially nonexistent. In addition, we feel that WIMPs provide a natural way for a critical density of dark matter to occur within the context of plausible particle theories. (AIP)

6402 Atmospheric Physics

REFER ALSO TO CITATION(S) 12099

12107 **(UCRL—99232) High energy laser beam scattering by atmospheric aerosol aureoles.** Rosen, L.C.; Ipser, J. (Lawrence Livermore National Lab., CA (USA)). Dec 1988. Contract W-7405-ENG-48. 11p. (CONF-890142—1). NTIS, PC A03/MF A01 - OSTI. Order Number DE89004811/JAW.

From Symposium on lasers and optics; Los Angeles, CA, USA (15 Jan 1989).

The interaction of high energy laser beams with aerosols in the atmosphere produces non-uniform temperature variations in the medium surrounding the aerosols. These non-uniformities in the ambient index of refraction act as scattering centers for the laser beam. The basic thermodynamics and conservation equations are solved numerically for pulsed high energy lasers interacting with aerosol water droplet systems. The resulting temperature variations at the surface of the aerosol and in the surrounding medium are found for a variety of input variables including absorbed laser intensity, pulse repetition rate, pulse time, and particle radius. The laser beam scattering is calculated through the Born approximation utilizing the computed temperatures. The range of variables for which laser beam scattering by aerosol aureole systems may be important is discussed. 17 refs., 6 figs., 2 tabs.

12108 **Reply.** Baker, D.N.; Blake, J.B.; Gorney, D.J.; Higbie, P.R.; Klebesadel, R.W.; King, J.H. (Goddard Space Flight Center, Greenbelt, MD). *Geophysical Research Letters;* **15**: No. 12, 1451-1452(Nov 1988).

The effect of the South Atlantic Anomaly on electron precipitation is considered. (AIP)

12109 **(AD-A—198716/3/XAB) Anomalies of the ionospheric F2 layer above Guangzhov region.** Qingming, H. (Air Force Systems Command, Wright-Patterson AFB, OH (USA). Foreign Technology Div.). 21 Jul 1988. Trans. of Kongjian Kexue Xuebao (China), Vol. 7, No. 2, 134-138(Apr 1987). (FTD-ID(RS)T—0394-88). 11p. NTIS, PC A03/MF A01.

The Guangzhou Ionospheric Observatory is located near the geomagnetic equator (geomagnetic coordinates; 183.0, E, 11.5, N), According to the analysis of ionospheric data from 18 observatories, Guangzhou is situated at the north crest of the double-crest where foF2 reaches its maximum value. During high solar-activity years, the maximum value of foF2 occurs even at night time. In addition, the occurring frequency of the ionospheric disturbances is higher than that at other observatories in China. These characteristics are all considered equatorial anomaly phenomena of the F2 layer.

6403 Atomic, Molecular, And Chemical Physics

REFER ALSO TO CITATION(S) 11405, 11498, 11504, 11512, 11514, 12160, 12269, 12382, 12411, 12411

12110 **(AD-A—199087/8/XAB) Inelastic helium-scattering studies of ordered Ar, Kr, and Xe monolayers physisorbed on Ag(111): dispersion curves, scattering cross sections, and excitation lineshapes. Interim technical report.** Gibson, K.D.; Sibener, S.J. (Chicago Univ., IL (USA). Dept. of Chemistry). 15 Jun 1988. 34p. (TR—12). NTIS, PC A03/MF A01.

Pub. in Jnl. of Chemical Physics, Vol. 88, No. 12, 7862-7892(15 Jun 1988).

This paper is the first in a series covering the authors experiments examining the physical properties of ordered overlayers of Ar, Kr, and Xe physisorbed on Ag(111). In this paper, they examine the desorption kinetics of the Xe monolayer/Ag(111) system. Desorption is zeroth order until approx. 90% of the monolayer has desorbed, then becomes first order. They also measured the inelastic scattering of an 18-meV He beam from unconstrained monolayers of (111) oriented Ar, Kr, and Xe. The transitions are mapped across the entire surface Brillouin zone from T and M. The data are

dispersionless, indicating that for the measured mode the adatoms are behaving as independent Einstein oscillators. Parametrized physisorption potentials for RG-Ag(111) (RG=Ar, Xe) are constructed using these results. Inelastic-scattering probabilities and linewidths also presented. The inelastic-scattering probabilities vary by at most a factor of 3 across the entire surface Brillouin zone, and are reported as a function of incident angle, final vector, and surface temperature.

12111 **(BLG—603) Ekamanganese elements.** Noddack, W.; Tacke, I.; Berg, O. (Berlin). (Centre d'Etude de l'Energie Nucleaire, Mol (Belgium)). Mar 1988. 24p. (In German). NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705238/JAW.

Translated from Naturwissenschaften (26 Jun 1925), v. 13 p. 567-574.

A recent study tends to revalidate the search for element 43 done in 1925. In ores with properties similar to the hypothetical chemical properties of the missing elements 43 and 75, the unknown elements were concentrated by chemical means. Roentgen-ray spectroscopy was applied in order to observe the characteristic Roentgen L lines for element 75 and K lines for element 43. Element 43 was observed in sperrylith, gadolinit, fergusonit and columbit. The name masurium was proposed. Similarly, element 75 was observed in tantalit, wolframit and platinit. The name rhenium was chosen. (MCB).

12112 **(CONF-881002—39) Experimental studies of self-suppression of vacuum ultraviolet generation in Xe.** Judish, J.P.; Allman, S.L.; Garrett, W.R.; Payne, M.G. (Oak Ridge National Lab., TN (USA)). Nov 1988. Contract AC05-84OR21400. 5p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004912/JAW.

From 35. national vacuum symposium and 4th international laser science conference; Atlanta, GA, USA (2 Oct 1988).

Vacuum ultraviolet light in the range 116 nm to 117 nm was produced by using a two-photon resonant four-wave mixing scheme in Xe. The buildup of coherent cancellation of the two-photon resonant transition employed in the generation of the vacuum ultraviolet, with resulting limitations imposed on the achievable vacuum ultraviolet intensity was investigated. Under certain predicted conditions, increases in the intensity of one of the pumping beams, ~1500 nm infrared, or tuning this beam towards resonance with the $5p^6 7s(3/2)_1$ level of Xe led, not to increases, but decreases in the vacuum ultraviolet generated. 3 refs., 3 figs.

12113 **(DOE/ER/13867—1) Atomic structure calculations on the CRAY X-MP.** Fischer, C.F. (Vanderbilt Univ., Nashville, TN (USA)). 1988. Contract FG05-88ER13867. 16p. (CONF-8804125—4). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005068/JAW.

From Computational atomic and nuclear physics at one gigaflop conference; Oak Ridge, TN, USA (14 Apr 1988).

Atomic structure calculations require both radial and angular integrations, where the latter are often based on Racah algebra. With relatively minor modifications, good performance is obtained on vector machines for radial integrations. Angular integrations, however, present the bottleneck. Some recent improvements in the algorithms for angular integrations are described, as well as some multitasking experiments on the CRAY X-MP and CRAY 2. These show that the workload can easily be distributed evenly among available processors with dynamic scheduling. 18 refs., 1 fig., 3 tabs.

12114 **(GSI—88-19) Dielectronic recombination in inner shells studied on medium-heavy ions by resonant electron capture and excitation.** Reusch, S. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.); Giessen Univ. (Germany, F.R.)). Sep 1988. 115p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88756352/JAW.

The aim of the experiments performed in the framework of this thesis was to maximize the reachable resolution in such experiments in order to be able to resolve as much single resonances as possible. For this the collisional systems /sub 22/Ti/sup 19+/ -> H/sub 2/ at the tandem/postaccelerator facility of the Heidelberg MPI for Nuclear Physics and /sub 32/Ge/sup 29,31+/ -> H/sub 2/ at the UNILAC of the GSI in Darmstadt were studied. (orig./HSI).

12115 **(INIS-mf—11873) High-resolution Auger spectroscopy on 79 MeV Ar/sup 5+/, 89 MeV Ar/sup 6+/, and 136 MeV Ar/sup 7+/ ions after excitation by helium.** Schneider, T. (Freie Univ. Berlin (Germany, F.R.). Fachbereich Physik). 3 Feb 1988. 168p. (In German). NTIS (US Sales Only), PC A08/MF A01. Order Number DE88756366/JAW.

In this thesis the atomic structure of highly excited Ar/sup 6+/ and Ar/sup 7+/ ions was studied. For this 79 MeV Ar/sup 5+/, 89 MeV Ar/sup 6+/, and 136 MeV Ar/sup 7+/ ions of a heavy ion accelerator were excited by a He gas target to autoionizing states and the Auger electrons emitted in the decay were measured in highly-resolving state. The spectra were taken under an observational angle of zero degree relative to the beam axis in order to minimize the kinematical broadening of the Auger lines. (orig./HSI).

12116 **(LA—11436-M-Vol.2) Theoretical Atomic Physics code development II: ACE: Another collisional excitation code.** Clark, R.E.H.; Abdallah, J. Jr.; Csanak, G.; Mann, J.B.; Cowan, R.D. (Los Alamos National Lab., NM (USA)). Dec 1988. Contract W-7405-ENG-36. 25p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89005293/JAW.

A new computer code for calculating collisional excitation data (collision strengths or cross sections) using a variety of models is described. The code uses data generated by the Cowan Atomic Structure code or CATS for the atomic structure. Collisional data are placed on a random access file and can be displayed in a variety of formats using the Theoretical Atomic Physics Code or TAPS. All of these codes are part of the Theoretical Atomic Physics code development effort at Los Alamos. 15 refs., 10 figs., 1 tab.

12117 **(LAL—87-53) Recent results from the UA2 experiment.** Repellin, J.P. (Paris-11 Univ., 91 - Orsay (France). Lab. de l'Accelerateur Lineaire). Nov 1987. 19p. (CONF-8708174—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756159/JAW.

From 7. international conference on physics in collision; Tsukuba, Japan (25 Aug 1987).

Recent results from the UA2 experiment at the CERN pantip collider are presented. The full statistics is used to measure the properties of the Intermediate Vector Bosons and to test the Standard Model. Searches for exotic processes are also described.

12118 **(PNRI(C)-IF—87005) JAX: a micro-computer based X-ray diffractometer controller.** Naval, P.C. Jr. (Philippine Atomic Energy Commission, Diliman, Quezon City). (Philippine Nuclear Research Inst., Diliman, Quezon City). May 1987. 41p. (CONF-8705356—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705216/JAW.

From National Physics Congress; Baguio City, Philippines (21 May 1987).

This paper describes a micro-computer based X-ray diffractometer controller and explores its possibilities in simplifying acquisition and analysis of X-ray powder diffraction data. The interrupt-driven controller can operate in both present time and present count data acquisition modes and allows a data analysis program to execute concurrently with data collection. (Auth.). 16 figs.; 2 tabs.

12119 **(UCRL—99925) Chaotic spectra: How to extract dynamic information.** Taylor, H.S.; Gomez Llorente, J.M.; Zakrzewski, J.; Kulander, K.C. (Lawrence Livermore National Lab., CA (USA)). Oct 1988. Contract W-7405-ENG-48. 47p. (CONF-8808174—1). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89003893/JAW.

From International conference on classical dynamics in atomic and molecular physics; Brioni, Yugoslavia (30 Aug 1988).

Nonlinear dynamics is applied to chaotic unassignable atomic and molecular spectra with the aim of extracting detailed information about regular dynamic motions that exist over short intervals of time. It is shown how this motion can be extracted from high

resolution spectra by doing low resolution studies or by Fourier transforming limited regions of the spectrum. These motions mimic those of periodic orbits (PO) and are inserts into the dominant chaotic motion. Considering these inserts and the PO as a dynamically decoupled region of space, resonant scattering theory and stabilization methods enable us to compute ladders of resonant states which interact with the chaotic quasi-continuum computed in principle from basis sets placed off the PO. The interaction of the resonances with the quasicontinuum explains the low resolution spectra seen in such experiments. It also allows one to associate low resolution features with a particular PO. The motion on the PO thereby supplies the molecular movements whose quantization causes the low resolution spectra. Characteristic properties of the periodic orbit based resonances are discussed. The method is illustrated on the photoabsorption spectrum of the hydrogen atom in a strong magnetic field and on the photodissociation spectrum of H_3^+. Other molecular systems which are currently under investigation using this formalism are also mentioned. 53 refs., 10 figs., 2 tabs.

12120 **(UCRL—99997) Heavy ion reaction studies of Nb + Au at E/A = 50, 75 and 100 MeV.** Fields, D.J.; Sangster, T.C.; Webb, M.L.; Remington, B.A.; Britt, H.C.; Hansen, L.F.; Lanier, R.G.; Massoletti, D.; Namboodiri, M.N.; Struble, G.L. (Lawrence Livermore National Lab., CA (USA)). 14 Nov 1988. Contract W-7405-ENG-48. 14p. (CONF-8810261—1). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004786/JAW.

From International workshop on nuclear dynamics at high energies; Bad Honner, F.R. Germany (10 Oct 1988).

We report on measurements of the system Nb + Au at incident energies of E/A = 50, 75 and 100 MeV made with a large solid angle, large dynamic range gas-scintillator array. We observe that in these reactions fission is the result of peripheral collisions. Somewhat less peripheral reactions result in heavy residues which do not undergo fission. More central reactions result in high multiplicities of light particles and intermediate mass fragments. Correlations between fragments, energetic light charged particles, and forward moving projectile-like fragments are presented to support these observations. 4 refs., 13 figs.

12121 **(UCRL—100055) Evaporative cooling of highly charged ions in EBIT [Electron Beam Ion Trap]: An experimental realization.** Schneider, M.B.; Levine, M.A.; Bennett, C.L.; Henderson, J.R.; Knapp, D.A.; Marrs, R.E. (Lawrence Livermore National Lab., CA (USA)). 1 Dec 1988. Contract W-7405-ENG-48. 9p. (CONF-881154—1). NTIS, PC A02/MF A01 - OSTI. Order Number DE89004776/JAW.

From International symposium on electron beam ion sources and their applications; Upton, NY, USA (14 Nov 1988).

Both the total number and trapping lifetime of near-neon-like gold ions held in an electron beam ion trap have been greatly increased by a process of 'evaporative cooling'. A continuous flow of low-charge-state ions into the trap cools the high-charge-state ions in the trap. Preliminary experimental results using titanium ions as a coolant are presented. 8 refs., 6 figs., 2 tabs.

12122 **Theoretical study of the dissociation energy of BH using quadratic configuration interaction.** Curtiss, L.A.; Pople, J.A. (Chemical Technology Division/Materials Science Program, Argonne National Laboratory, Argonne, Illinois 60439). *Journal of Chemical Physics;* **90**: No. 4, 2522-2523(15 Feb 1989).

An ab initio molecular-orbital study of the dissociation energy of boron monohydride of (BH) using quadratic configuration interaction and a large basis set is presented. The results suggest that the commonly accepted value for the dissociation energy D/sub o/ of BH of 78.9 kcal/mol may be low by about 3— 4 kcal/mol.

12123 **Spectra in the chaotic region: Methods for extracting dynamic information.** Gomez Llorente, J.M.; Zakrzewski, J.; Taylor, H.S.; Kulander, K.C. (Department of Chemistry, University of Southern California, Los Angeles, California 90089-0482). *Journal of Chemical Physics;* **90**: No. 3, 1505-1518(1 Feb 1989).

Nonlinear dynamics is applied to chaotic unassignable atomic and molecular spectra with the aim of extracting detailed information about regular dynamic motions that exist over short intervals of time. It is shown how this motion can be extracted from high resolution spectra by doing low resolution studies or by Fourier transforming limited regions of the spectrum. These motions mimic those of periodic orbits (PO) and are inserts into the dominant chaotic motion. Considering these inserts and the PO as a dynamically decoupled region of space, resonant scattering theory and stabilization methods enable us to compute ladders of resonant states which interact with the chaotic quasicontinuum computed in principle from basis sets placed off the PO. The interaction of the resonances with the quasicontinuum explains the low resolution spectra seen in such experiments. It also allows one to associate low resolution features with a particular PO. The motion on the PO thereby supplies the molecular movements whose quantization causes the low resolution spectra. Characteristic properties of the periodic orbit based resonances are discussed. The method is illustrated on the photoabsorption spectrum of the hydrogen atom in a strong magnetic field and on the photodissociation spectrum of H^+_3 . Other molecular systems which are currently under investigation using this formalism are also mentioned.

12124 **Vibrationally resolved shape resonant photoionization of N_2O.** Kelly, L.A.; Duffy, L.M.; Space, B.; Poliakoff, E.D.; Roy, P.; Southworth, S.H.; White, M.G. (Department of Chemistry, Boston University, Boston, Massachusetts 02215). *Journal of Chemical Physics;* **90**: No. 3, 1544-1550(1 Feb 1989).

We report a vibrationally resolved dispersed fluorescence study of $7\sigma^{-1}$ shape resonant photoionization in N_2O. Previous work indicates that there are two shape resonances in the $\epsilon\sigma$ channel, and our results demonstrate that the lower energy shape resonance (hν/sub exc/≅20 eV) results in non-Franck—Condon vibrational branching ratios over a wide range. Moreover, the cross section curves for alternative vibrational modes behave differently, and we show that the symmetric stretch exerts a greater influence on resonance behavior than the asymmetric stretching vibration. Such comparisons of vibrationally resolved partial cross section curves provide qualitative insights into the shape resonant photoionization dynamics for polyatomic targets. The higher energy shape resonance is apparently masked by the presence of the dominant nonresonant $\epsilon\pi$ channel. In addition to information on the photoionization dynamics, these results also provide spectroscopic data on the ionic potential surfaces. Specifically, we obtain ratios of Franck—Condon factors for N_2O^+ (A→X) transitions which are useful for testing calculated properties of the ion.

12125 **Vibrationally resolved photoelectron studies of the $7\sigma p1$ channel in N_2O.** Ferrett, T.A.; Parr, A.C.; Southworth, S.H.; Hardis, J.E.; Dehmer, J.L. (Radiometric Physics Division, National Bureau of Standards, Gaithersburg, Maryland 20899). *Journal of Chemical Physics;* **90**: No. 3, 1551-1556(1 Feb 1989).

We present vibrationally resolved photoelectron studies of the 000, 100, 200, and 001 modes of the A-italic-tilde state ($7\sigma^{-1}$) of N_2 O^+ in the 17.4—26 eV photon-energy range. The vibrational branching ratios $\sigma(100)/\sigma(000)$ and $\sigma(001)/\sigma(000)$ agree very well with fluorescence measurements by Kelly et al. and qualitatively with recent theoretical predictions of Braunstein and McKoy. The large non-Franck—Condon variations in the $\sigma(100)/\sigma(000)$ and $\sigma(200)/\sigma(000)$ branching ratios are associated with a predicted $7\sigma\rightarrow\epsilon\sigma$ shape resonance near 20 eV. Overall, the vibrational branching ratios imply lower resonant energies for the stretching modes (100 and 200) and a similar resonant energy for the asymmetric stretch (001), compared with the 000 mode. The vibrational asymmetry parameters (β) display a strong variation with energy which is qualitatively reproduced by theory; however, the experimental values for $\beta(100)$ and $\beta(001)$ exhibit additional structure around 20 eV. When combined with theory and recent fluorescence data, these results help to demonstrate a correlation of shape resonance energy with overall molecular length (R/sub N//sub —// sub N/+R/sub N//sub —//sub O/); this important result implies a resonant state which is localized on the entire triatomic molecular frame rather than on the N—N or N—O components.

12126 **Connection between energy relations of solids and molecules.** Smith, J.R.; Schlosser, H.; Leaf, W.; Ferrante, J.; Rose, J.H. (Physics Department, General Motors Research Laboratories, Warren, Michigan 48090-9055). *Physical Review [Section] A: General Physics;* **39**: No. 2, 514-517(15 Jan 1989).

The universal energy relation, discovered for metallic and covalent solids as well as nuclear matter, is tested for diatomic molecules. We find that it applies well to covalent diatomic bonds, but that ionic diatomic bonds are in a distinct class. A simple extension of the universal binding energy relation that includes the effects of ionicity ensues. It yields accurate predictions of spectroscopic data for both ionic and covalent bonds in 150 molecules. The form of the covalent part is given by the universal relation, suggesting an intimate relationship between the energetics of solids and diatomic molecules.

12127 **Precision x-ray crystal spectroscopy of neonlike gold.** Chandler, G.A.; Chen, M.H.; Dietrich, D.D.; Egan, P.O.; Ziock, K.P.; Mokler, P.H.; Reusch, S.; Hoffmann, D.H.H. (University of California, Lawrence Livermore National Laboratory, Livermore, California 94550). *Physical Review [Section] A: General Physics;* **39**: No. 2, 565-569(15 Jan 1989).

The spectrum of neonlike gold (+69) is observed in a beam-foil light source utilizing an x-ray crystal spectrograph. Precision wavelength determinations indicate variations from multi- configurational Dirac-Fock calculations for states sampling the 2s hole states consistent with previous observations in bismuth (+73).

12128 **Comprehensive calculations of 4p and 4d lifetimes for the Cu sequence.** Curtis, L.J.; Theodosiou, C.E. (Department of Physics and Astronomy, The University of Toledo, Toledo, Ohio 43606). *Physical Review [Section] A: General Physics;* **39**: No. 2, 605-615(15 Jan 1989).

Computed lifetimes for the 4p ^{2}P/sub 1/2/, 4p^{2}P/sub 3/2/, 4d ^{2}D/sub 3/2/, and 4d^{2}D/sub 5/2/ levels in the copper isoelectronic sequence are presented for atomic numbers Z = 29—92. These calculations agree well with recent high-precision lifetime measurements, conflict with the isoelectronic trend of single-configuration Dirac-Fock calculations, and agree at lower Z with the multiplet values of multiconfiguration Hartree-Fock calculations using experimental transition energies. Our calculations involve the inclusion of experimental energy-level data and the use of a Hartree-Slater potential to represent the ionic core. It is found that the core-polarization effects are significant and must be included to obtain agreement with experiment, at least for the lower members of the isoelectronic sequence. As part of the study, we have combined semiempirical parametrizations of the existing database with Dirac-Fock calculations to produce a set of values for the ionization potentials and the 4p and 4d excitation energies for all stable ions in this sequence.

12129 **Numerical multiconfiguration self-consistent-field studies of atomic photoionization cross sections: Dynamical core-polarization effects in atomic potassium.** Saha, H.P. (Department of Physics, University of Central Florida, Orlando, Florida 32816-0993). *Physical Review [Section] A: General Physics;* **39**: No. 2, 628-633(15 Jan 1989).

The numerical multiconfiguration self-consistent-field method is used to calculate photoionization cross sections of atomic potassium in its ground state for photoelectron energies ranging from 0.0 to 12 eV. The effects of core polarization, which are very important for this atom, are analyzed in detail and are taken into account effectively ab initio in both the initial and the final state, by the configuration-interaction procedure. It is found that the core-polarization effect is very strong in the photoionization cross section of potassium. Our results are found to be in good agreement with previous theoretical calculations throughout the energy region considered and also with experiment except at high energies.

12130 **Effect of anisotropy on the sticking in muon-catalyzed fusion determined by the x-ray method.** Cohen, J.S.; Padial, N.T. (Theoretical Division, Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Physical Review [Section] A: General Physics;* **39**: No. 2, 915-918(15 Jan 1989).

The initial sticking in the 2p/sub m/ states of muonic helium in muon-catalyzed fusion (μCF) and the subsequent collisional excitation to these states are shown to have nonstatistical dependences on m that result in spatial anisotropy of the emitted x rays. This anisotropy, I(0°)/I(90°), is found to be 0.71 for d-d μCF and 1.12 for d-t μCF in liquid targets, where the angle is between the coincidentally detected x ray and neutron. The effect is predicted to increase the actual Kα x-ray yield and corresponding sticking observed in a recent d-t μCF experiment by 4%. The Doppler broadening of the radiation observed at different angles is also examined.

12131 **Comment on "Laser-induced continuum structure in xenon".** Tang, X.; L'Huillier, A.; Lambropoulos, P. (Physics Department, University of Southern California, Los Angeles, California 90089-0484). *Physical Review Letters;* **62**: No. 1, 111-111(2 Jan 1989).

A Comment on the Letter by M. H. R. Hutchinson, and K. M. M. Ness, Phys. Rev. Lett. 60, 105 (1988).

12132 **Autoionizing resonances 4d→nl in cadmium.** Jimenez-Mier, J.; Caldwell, C.D.; Krause, M.O. (Oak Ridge National Laboratory, Oak Ridge, Tennessee 37831). *Physical Review [Section] A: General Physics;* **39**: No. 1, 95-102(1 Jan 1989).

We measured the relative cross section and angular distribution parameter for 5s photoelectron emission in atomic cadmium across the region of the 4d→nl autoionizing resonances between 11.70 and 18.05 eV. Our results for the oscillator strengths agree with Hartree-Fock calculations, and are higher than the values reported by other experiments. Strong departure from the direct-process value of 2.0 was observed for the angular distribution parameter β, indicating singlet-to-triplet mixing in the wave functions. The mixing varies in the np resonance series, while it remains almost constant throughout the nf series. In the region of the 5p resonances there is good agreement with a semiempirical calculation of the asymmetry parameter. A number of double-electron excitations were investigated and the value of β was used to give the correct assignment to a transition at 12.856 eV. A previously unobserved transition corresponding to the promotion of a 4d electron to the 5d orbit was detected by the change in the value of β.

12133 **Saddle-point scaling method for ionizing collisions.** Irby, V.D. (Laboratory for Atomic and Molecular Research and Department of Physics, University of Missouri—Rolla, Rolla, Missouri 65401). *Physical Review [Section] A: General Physics;* **39**: No. 1, 54-57(1 Jan 1989).

Scaling laws have been derived for total single-ionization cross sections from the classical picture of saddle-point ionization. The results agree with experimental data for the projectile-charge dependence of the energy position of cross-section maxima and for the values of the cross-section maxima.

12134 **Dielectronic-recombination cross section for N/sup 2+/, O/sup 3+/, and F/sup 4+/.** Nasser, I.; Hahn, Y. (Department of Physics, King Fahd University of Petroleum & Minerals, Dhahran 31261, Saudi Arabia). *Physical Review [Section] A: General Physics;* **39**: No. 1, 401-404(1 Jan 1989).

Dielectronic-recombination cross sections are estimated for ions of the B isoelectronic sequence (N/sup 2+/, O/sup 3+/, and F/sup 4+/) in which the 2s→2p excitation is involved during the initial capture. Different Auger channels for the core states ^{2}P, ^{2}D, ^{2}S, and ^{4}P are explicitly included. An approximate field-enhancement factor for the maximum mixing is given.

12135 **X-ray and vacuum ultraviolet interaction data bases, calculations, and measurements; Proceedings of the Meeting, Los Angeles, CA, Jan. 14, 15, 1988.** Del Grande, N.K.; Lee, P.; Samson, J.A.R.; Smith, D.Y. Bellingham, WA; Society of Photo-Optical Instrumentation Engineers (1988). 214p. (CONF-8801115—).

From X-ray and vacuum ultraviolet interaction data bases, calculations, and measurements; Los Angeles, CA, USA (14 Jan 1988).

Various papers on X-ray and vacuum ultraviolet interaction data bases, calculations, and measurements are presented. Individual topics addressed include: photoabsorption and photoionization cross sections, a program to obtain reliable photoabsorption cross sections, photoionization of small molecules using synchrotron radiation, components of the photoionization cross section in the VUV and soft X-ray region, photoabsorption and fluorescence cross sections of halogen compounds in VUV, near-threshold X-ray fluorescence spectroscopy of molecules, atomic processes in tokamak plasmas, and photoionization studies of atomic oxygen and nitrogen. Also considered are: constraints and data base of X-ray optical properties, theory of anomalous X-ray scattering from atoms and ions, preparation of multilayered X-ray photoabsorption targets, composition and thickness of multilayer foils using MeV ion-beam techniques, recent developments with VUV and soft X-ray detector systems, and measurements of X-ray fluorescence yields of plastics by photoexcitation.

6404 Fluid Physics

REFER ALSO TO CITATION(S) 11536, 11580, 12500

12136 **(UCID—21609) Tailoring domain decomposition to the network structure for parallel processing of fluid dynamics.** Perkins, A.L. (Lawrence Livermore National Lab., CA (USA)). Nov 1988. Contract W-7405-ENG-48. 21p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005501/JAW.

We developed a biased domain decomposition clustering algorithm designed for use in our parallel processing program for the numerical solution of partial differential equations. The biased clustering algorithm is designed to work on a distributed memory parallel processor with a general network communication system connecting the individual processor units. To date, the algorithm has been simulated on the Cray-2 shared memory multiprocessor. 18 refs., 8 figs.

12137 **Analysis of the H_2 vibrational distribution in a hydrogen discharge.** Hiskes, J.R.; Karo, A.M. (Lawrence Livermore National Laboratory, University of California, Livermore, California 94550). *Applied Physics Letters;* **54**: No. 6, 508-510(6 Feb 1989).

The $H_2(v'')$ vibrational distribution observed in a medium-density hydrogen discharge is analyzed in terms of standard collisional processes. All processes in the model are specified independently of adjustable parameters. The calculated distribution is found to be a sensitive function of the wall relaxation process. The warm-gas-temperature discharge analyzed here leads to a substantially more rapid $H_2(v'')$ wall relaxation than is inferred from cold-gas systems.

12138 **Spiral turbulence and phase dynamics.** Hegseth, J.J.; Andereck, C.D.; Hayot, F.; Pomeau, Y. (Department of Physics, Ohio State University, 174 West 18th Avenue, Columbus, Ohio 43210). *Physical Review Letters;* **62**: No. 3, 257-260(16 Jan 1989).

Hysteretic spiral turbulence is a remarkable phenomenon of coexistence of turbulent and laminar domains in Taylor-Couette flow. We observe and measure for the first time a nonuniform pitch in long geometries and its dependence on boundary conditions at the cylinder ends, and we explain these results within the framework of phase dynamics. We also discuss the influence of secondary flow on the azimuthal width of the spiral.

12139 **New results for spin waves and the Leggett-Rice effect in ^{3}He-^{4}He mixtures.** Bedell, K.S. (Los Alamos National Laboratory, T-11, MS B262, Los Alamos, New Mexico 87545). *Physical Review Letters;* **62**: No. 2, 167-170(9 Jan 1989).

Recent experiments on spin waves in ^{3}He-^{4}He mixtures suggest that the interaction parameter λ, where $\lambda = (1+F_0/\text{sup a/})/\text{sup -1/-(1 +}F_1/\text{sup a//3)/sup -1/}$, vanishes for a value of the ^{3}He concentration between 3% and 5%. At this concentration some new features in the dispersion and attenuation of the spin-wave modes will appear. Moreover, when $\lambda = 0$, the Leggett-Rice effect disappears. Measuring the dispersion of the spin-wave mode in this regime provides a unique experiment in which two Fermi-liquid parameters, $F_0/\text{sup a/}$ and $F_1/\text{sup a/}$, are obtained.

12140 **Noise-sustained structures in the Kuramoto-Sivashinsky equation.** Brand, H.R.; Deissler, R.J. (Fachbereich 7, Physik, Universitaet Essen, Gesamthochschule, Universitatsstrasse 5, Postfach 103chemical bond764, D-4300 Essen 1, West Germany). *Physical Review* [*Section*] *A: General Physics;* **39**: No. 1, 462-465(1 Jan 1989).

We investigate the interaction between external noise and spatial degrees of freedom for the Kuramoto-Sivashinsky (KS) equation with and without damping, a prototype equation which is known to show weak spatial turbulence and which arises in many areas including flame fronts, flow down an inclined plane, convection between insulating boundaries, etc. We show that the KS equation can be convectively unstable and can lead to noise-sustained structures.

12141 **Tearing mode energy principle for an axisymmetric force-free plasma.** Chu, M.S.; Chance, M.S.; Greene, J.M.; Jensen, T.H. (General Atomics, San Diego, California 92138-5608). *Physics of Fluids B: Plasma Physics;* **1**: No. 1, 62-67(Jan 1989).

A self-adjoint, gauge invariant stability functional $\delta W/\text{sub T//sub G/}$ for determination of a sufficient condition of tearing mode stability is obtained for a plasma with a uniform pressure. The plasma is stable if there is no free energy available to support energy flux into the singular layer. The Δ' concept, valid in simple geometries, is generalized to reflect variation of equilibrium quantities on the flux surface. The relationship of $\delta W/\text{sub T//sub G/}$ to the ideal stability functional and other possible forms of tearing mode stability functionals is clarified through gauge transformations.

12142 **Momentum flux in multiphase mixtures.** Passman, S.L.; McTigue, D.F. (Sandia National Laboratories, Division 6212, Albuquerque, New Mexico 87185). *Journal of Rheology;* **33**: No. 1, 177-182(Jan 1989).

Bodies which are mixtures, in the sense that reasonably small elements of such bodies contain particles of two or more materials or phases, are of major interest in many physical applications. For the purpose of constructing mathematical models, mixtures may be divided into two classes: solutions, or homogeneous mixtures, in which the phases are so intimately intermixed that all phases may be thought of as occupying the same points in space at the same time, and multiphase mixtures, in which each phase occupies a portion of space that is different from each other phase. Physical materials appropriate to multiphase mixture theories include suspensions of solid particles in a fluid, and fluids in the interstices of deformable porous media. The theory of solutions is well-established. For multiphase mixtures, the governing physical principles still are being debated, though generally it is agreed that at least part of the theoretical structure should be similar to that for solutions. Here we discuss multiphase mixture theory.

6450 High Energy Physics

REFER ALSO TO CITATION(S) 12289

12143 **(DOE/ER/40213—5) Theory and phenomenology of strong and weak interaction high energy physics: Progress report.** (Arizona Univ., Tucson (USA). Dept. of Physics). 29 Dec 1988. Contract FG02-85ER40213. 13p. NTIS, PC A03 - OSTI. Order Number DE89005557/JAW.

This paper discusses topics of weak and strong interactions in High Energy Physics. Theories relating to quantum chromodynamics are mainly covered. The standard model is discussed. Experiments at the Fermilab Collider on heavy flavor, jet models, particle rapidity, multiplicity distributions, particle production, and phase transitions in nucleon-nucleon interactions are also discussed. (LSP)

12144 **(DOE/FTR—9003592) [Collaboration on Experiment NA34, Geneva, Switzerland, International symposium on position detectors for high energy physics, Dubna, USSR, and Workshop on physics of intermediate and high energy heavy-ion reactions, Krakow, Poland, September 17--October 8, 1987].** Ludlam, T.W. (Brookhaven National Lab., Upton, NY (USA)). 15 Oct 1987. Contract AC02-76CH00016. 5p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89003592/JAW.

New developments in detectors were discussed at Dubna, with emphasis on the Soviet and CERN programs. The Krakow meeting focused on interpreting data from high energy heavy ion collisions. At CERN, the data-taking with high energy sulfur beams went very satisfactorily.

12145 **(TRI-PP—88-71) Future directions in nuclear and particle physics.** Vogt, E. (TRIUMF, Vancouver, British Columbia (Canada)). Sep 1988. 5p. (CONF-880688—3). NTIS (US Sales Only), PC A02/MF A01 - OSTI. Order Number DE89005049/JAW.

From Summer workshop of the continuous electron beam accelerator facility; Newport News, VA, USA (20 Jun 1988).

With the advent of the standard model of quarks, leptons and unified forces one has achieved an understanding of the wealth of data in particle physics and provided a new basis for the understanding of nuclei and hadrons. In particle physics one now seeks to improve the standard model and to go beyond it. In nuclear physics one inquires about the role of quarks and gluons in the dynamics of strongly interacting systems. To answer these new questions an impressive network of large accelerator facilities, including CEBAF, is under construction or in the proposal stage. A global view of this network and its physics is given. 3 figs., 1 tab.

6451 Particle Interactions And Properties - Experimental

REFER ALSO TO CITATION(S) 11657, 12188, 12189, 12194, 12204, 12209, 12212, 12240

12146 **(BNL—41987) A review of experimental progress in gluonia.** Lindenbaum, S.J. (Brookhaven National Lab., Upton, NY (USA); City Coll., New York (USA)). 4 Oct 1988. Contract AC02-76CH00016;AC02-83ER40107. 7p. (CONF-880867—16). NTIS, PC A02/MF A01 - OSTI. Order Number DE89004893/JAW.

From 24. international Rochester conference on high energy physics; Munich, F.R. Germany (4 Aug 1988).

There has been considerable progress in gluonia investigations and their analysis. As requested by the Convenor, Rich Galik, I will cover the highlights of various conference papers and related work in an integrated manner which incorporates a review of the present state of glueballs (gluonia) to the extent space limitations allow. There are four general methods of searching for glueballs: J/ {psi} radiative decay [iota, θ, $\xi(2.2)$]; OZI violating (g/sub T/, g/ sub T/', g/sub T/{double←prime}); hadronic interaction pattern recognition of extra isosinglet states in addition to q{bar q} nonets, iota, G, S*', g/sub s/; and double Pomeron exchange. These will be reviewed. 4 refs., 4 figs.

12147 **(BNL—42023) Determination of sin^2*L*/sub w/ by muon neutrino and anti-neutrino scattering by electrons.** Abe, K.; Ahrens, L.A.; Amako, K.; Aronson, S.H.; Beier, E.W.; Callas, J.L.; Connolly, P.L.; Cutts, D.; Diwan, M.V.; Doughty, D.C. (Brookhaven National Lab., Upton, NY (USA)). 1988. Contract AC02-76CH00016. 12p. (CONF-8806204—8). NTIS, PC A03/MF A01 - OSTI. Order Number DE89004896/JAW.

From 13. international conference on neutrino physics and astrophysics; Boston, MA, USA (5 Jun 1988).

Total and differential cross sections for ν/sub μ/ and {bar {nu}}/sub μ/ elastic scattering by electrons were measured. The best value of sin$^2\theta$/sub w/, obtained by fits to the differential distributions, was found to be sin$^2\theta$/sub w/ = 0.195 +- 0.018 +- 0.013. 11 refs., 3 figs., 1 tab.

12148 **(BNL—42105) Strangeness production in {bar P}-nucleus interactions.** Dover, C.B.; Koch, P. (Brookhaven National Lab., Upton, NY (USA); State Univ. of New York, Stony Brook (USA)). 1988. Contract AC02-76CH00016;AC02-76ER13001. 18p. (CONF-8810264—1). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004892/JAW.

From Conference on hadronic matter in collision; Tucson, AZ, USA (6 Oct 1988).

The available data on production of strange particles (K/sub S/, Λ,{bar {Lambda}}) in {bar p}-nucleus annihilation from 0--4 GeV/c are interpreted in the context of a conventional hadronic picture, including final state interactions. The essential features of the data, namely the energy independence of the Λ/K/sub S/ ratio and the weak dependence of the Λ yield on the target mass number A are explained without recourse to quark-gluon plasma formation. 42 refs., 3 figs.

12149 **(CEA-N—2571) Study os associated production of an electron and jets in the UA1 experiment: search for the top quark.** Colas, P. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Inst. de Recherche Fondamentale (IRF)). Jul 1988. 316p. (In French). NTIS (US Sales Only), PC A14/MF A01. Order Number DE88756234/JAW.

We attempt to find evidence for top quark production in proton-antiproton interactions at 630 GeV center of mass energy. We use the semi-leptonic decay signature: presence of a high transverse energy electron accompanied by jets. The rate and the properties of the events originating from the known processes and from the misidentified-hadron background are estimated, the former using Monte-Carlo algorithms fitted to real data, the latter by an original method based on the data themselves. A good agreement is observed between these predictions and the data. This allows us to set limits on the QCD top quark production cross-section and the top quark mass. We obtain, for an "average" theoretical cross-section, that this mass should be greater than 38 GeV, at the 95% confidence level; the systematic experimental uncertainties on this limit are about 4 GeV. This improves the present limit of 23.3 GeV. Beside this, we show that if the top quark mass is of the order of, or greater than, the W mass, there is a perfectly clear signature of its production, and we study the peculiar kinematics and dynamics relevant to this case. Using the measurement of the lepton pair production cross-sections via W and Z boson decays, we show that it is possible, in principle, to set an upper limit on the top quark mass, but that, in practice, the present knowledge of the proton structure functions is too poor to allow us to set such a limit.

12150 **(DOE/ER/03072—47) Pion and nucleon structure as probed in the reaction π/sup +-/N $\rightarrow \mu^+\mu^-$X at 253 GeV.** McDonald, K.T. (Princeton Univ., NJ (USA). Joseph Henry Labs.). 19 Sep 1988. Contract AC02-76ER03072. 13p. (CONF-8809224—1). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89003669/JAW.

From Workshop on high-P{sub T} physics and higher twists; Paris, France (21 Sep 1988).

New results are presented from Fermilab experiment E615, in which hadroproduction of muon pairs allows a determination of the quark structure of the initial-state hadrons in the context of a Drell-Yan model. Comparison of muon-pair production by π^+ and

π^- beams shows the cross-section ratio follows Drell-Yan model expectations, except for a dip in $\sigma(\pi^+)/\sigma(\pi^-)$ near x/sub π/ near 1. The same data are also used to extract the ratio of the sea to valence quark distributions in the nucleon, with improved accuracy for x/sub N/ < 0.1 compared to deep-inelastic neutrino scattering. The Drell-Yan analysis of continuum muon-pair production has been extended down to a mass of 3.2 GeV/c^2 for the π^- data sample. This provides stronger evidence of a rise in the nucleon structure function for x/sub N/ < 0.06 compared to that extracted in deep-inelastic lepton scattering. The issue is raised of the nonuniqueness of the definition of x/sub π/ and x/sub N/ used in the Drell-Yan analysis. A definition proposed by Soper has superior invariance properties to that commonly used. An analysis based on this definition yields generally similar results for the pion and nucleon structure function, compared to use of the common definition. However, the pion structure function shows a larger intercept at x/sub π/ $= 1$ when the definition of Soper is used. 21 refs., 6 figs.

12151 **(DOE/ER/40150—52) Electroproduction of baryon resonances above the δ(1232).** Burkert, V. (Southeastern Universities Research Association, Newport News, VA (USA). Continuous Electron Beam Accelerator Facility). 1988. Contract AC05-84ER40150. 18p. (CEBAF-PR—88-012). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005549/JAW.

Results of electroproduction studies of the higher resonances are reviewed and compared to quark model calculations and to predictions from quark counting rules and QCD sum rules. 30 refs., 18 figs.

12152 **(DOE/ER/40193—2) Investigation of hadronic matter at the Fermilab Tevatron Collider: Technical progress report.** Anderson, E.W. (Iowa State Univ. of Science and Technology, Ames (USA)). 30 Nov 1988. Contract AC02-85ER40193. 11p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005554/JAW.

Contract AC02-85ER40193 supports an investigation of hadronic matter at very high energy densities. The present experiment, E-735, is a search for a deconfined quark-gluon plasma phase of hadronic matter predicted to occur when temperatures of 240 MeV are achieved. Preliminary data were obtained during the first operation of the Fermilab Tevatron Collider during the period January to May 1987. Based on these data the collaboration has published first results on the charged particle multiplicity and transverse momentum distributions. In addition, we have data on the particle identification of the produced secondaries, and publications are in preparation. Both measurements are regarded on theoretical grounds to be sensitive indicators of the formation of a high temperature plasma. We are currently in the principal data acquisition phase, which began in the spring of 1988. We now have in place our complete detector, including the central tracking chamber. Tests will also be made on backgrounds and detector materials appropriate to our proposal, P-787, to measure leptons and photons in the third Collider running period.

12153 **(DOE/ER/40445—5) A search for the production of direct leptons in nucleon-nucleus and nucleus-nucleus collisions: Annual progress report for the year April 1, 1988--March 31, 1989.** Kirk, P.N. (Louisiana State Univ., Baton Rouge (USA). Intermediate Energy Nuclear Physics Group). 15 Dec 1988. Contract FG05-88ER40445. 25p. NTIS, PC A03 - OSTI. Order Number DE89004370/JAW.

This paper contains calculations of the ratio of electrons to pions for numerous combinations of angles and momenta. (LSP)

12154 **(DOE/FTR—9005116) [24th international conference on high energy physics, Munich, Germany, August 2--11, 1988]: Foreign trip report.** Kycia, T.F. (Brookhaven National Lab., Upton, NY (USA)). 8 Sep 1988. Contract AC02-76CH00016. 5p. NTIS, PC A02/MF A01 - OSTI. Order Number DE89005116/JAW.

I learned of the most recent results on the possible range of the top quark mass, confirmation of B {minus} {bar B} mixing, and a lower limit on the fourth generation lepton if it exists. It impacts on our rare K^+ meson decay experiment. I learned that an experiment to carry out a similar search was being considered for KEK. I had some interesting conversations on the proposed K Meson Factory at TRIUMF. The high energy community in Canada does not endorse the project. A mixed discipline committee reviewing the proposal gave a negative recommendation. I was told that the Japanese may make only a token offer of providing beams for experiments that they might propose. International support is necessary for the approval of the project.

12155 **(FRCEA-TH—81) Investigation and realization at the Saclay linear accelerator of a line from a tagged photon beam bremsstrahlung in a wide energy range: Application to the measurement of the total cross section of the photofission (γ, f) of uranium 238.** Bourgeois, P. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Physique Nucleaire; Conservatoire National des Arts et Metiers (CNAM), 75 - Paris (France)). Dec 1986. 114p. (In French). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88756132/JAW.

A monochromatic tagged photon facility is described. The source is produced by tagging the photons from a continuous bremsstrahlung spectrum resulting from a monoenergetic electron beam traversing a thin target. A magnetic spectrometer is used to detect and measure the energy of the tagged electrons associated with the tagged photons. Tagging system characteristics include: 16 adjacent paths; a tagged energy range equal to 20% to 80% of the energy of the electrons of the incident beam; a constant relative resolution of the tagged energy bands equal to +-4%. The acquisition system is described and an example of the use of the system (measurement of the total cross section of photofission of U238 between 20 and 120 MeV) is shown. Tests show that the system can cover a range of monochromatic photon energy from 12 to 176 MeV, divided into 32 energy bands, with only two adjustements to the accelerator.

12156 **(IFVE-OEF—88-76) Determination of the cross section of the π/sup +/π/sup -/->π/sup 0/π/sup 0/ process in the dipion mass range 0.55<M<2.0 GeV from the π/sup -/p->π/sup 0/π/sup 0/n reaction at 39.1 GeV/c.** Apokin, V.D.; Arestov, Yu.I.; Belikov, N.I. and others. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1988. 10p. NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS. Order Number DE88705257/JAW.

Submitted to the journal Sov. J. Nucl. Phys. .

The total cross section for the process π/sup +/π/sup -/->π/sup 0/π/sup 0/ in the dipion mass range 0.55<M<2.0 GeV has been determined from the peripheral transition π/sup -/->π/sup 0/π/sup 0/ on the carbon and propane-diol targets at the initial π/sup -/-momentum 39.1 GeV/c. 22 refs.; 6 figs.

12157 **(IFVE-OEF—88-79) First results on azimuthal asymmetry measurement of π/sup 0/-meson production in a region of beam fragmentation on polarized deuterons.** Apokin, V.D.; Astaf'ev, O.V.; Bagaturiya, Yu.Sh. and others. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij; Tbilisskij Gosudarstvennyj Univ. (USSR)). (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1988. 6p. (In Russian). NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS. Order Number DE88705258/JAW.

Submitted to the journal Sov. J. Nucl. Phys. .

Azimuthal asymmetry of πdeg mesons produced in π/sup -/ , K/sup -/, p-bar + d/sub arrow up/ ->πdeg + X inclusive reactions with polarized deuteron has been measured at 40 GeV/c. Measurements have been carried out in the kinematic range of p-bar/sub T/=0-1.1 GeV/c and x=0.3-0.9. The asymmetry is compatible with zero at small transfer momenta and differs from zero by 1.5-3 standard deviations at p/sub T/>or approx0.7 GeV/c and x>or approx.0.7. 7 refs.; 2 figs.; 2 tabs.

12158 **(IFVE-ONF—88-81) Test of the ν/sub e/-ν/sub μ/ universality and search for the neutrino oscillations.** Ammosov, V.V.; Belikov, S.V.; Bugorskij, A.P. and others. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1988. 10p. (In Russian). NTIS (US Sales Only), PC A02/ MF A01 - OSTI; INIS. Order Number DE88705261/JAW.

Submitted to the journal Z. Phys., C.

83 events corresponding to the electron neutrino interactions in the charged-current channel have been selected from the neutrino experiment with SKAT chamber. Calculational (on the assumption of ν/sup (sub e/-ν/sub μ/-universality) and experimental numbers of events produced by electron and muon neutrino interactions in the charged current at E/sub ν/=3-30 GeV have been compared. For the value R=(N/sub νe//N/sub $\nu\mu$/)/sub exper.//(N/ sub νe//N/sub $\nu\mu$/)/sub cal/ /sub ./ have been obtained R=0.98+-0.15. The behaviour of this relation depending on the scaling variable y, as well as the agreement of the experimental and calculational distributions for the basic characteristics of ν/sub e/- events have been studied. The results obtained do not contradict the hypothesis of leptonic universality. Limitations to the value of the neutrino oscillations paramete rs ν/sub μ/reversibleν/sub e/ are presented. The upper limi ts for 90 deg C. L. are: δm/sup 2/=1.3 eV/sup 2/ (sin/sup 2/2θ1) and sin/sup 2/2θ=2.5x10/sup -3/(δm/ sup 2/$\cong$60 eV/sup 2/). 18 refs.; 6 figs.

12159 **(INIS-mf—11866) Determination of the coupling constant of the strong interaction in e/sup +/e/sup -/ reactions.** Dieckmann, A. (Heidelberg Univ. (Germany, F.R.). Naturwissenschaftlich-Mathematische Gesamtfakultaet). 1987. 116p. (In German). NTIS (US Sales Only), PC A06/ MF A01. Order Number DE88756359/JAW.

In this thesis the scale parameter Λ/sub MS/ of the coupling constant of the strong interaction α/sub s/ was experimentally determined in the framework of the perturbation-theoretical approach in second-order QCD by direct comparison of infrared-integrable observables of the e/sup +/e/sup -/ annihilation. Because the diverging quarks and gluons produced in the e/sup +/e/sup -/ collision with high energy change before the measurement into hadronic particles to the calculable contribution of the observed quantity a contribution is to be added which originates from the transition called fragmentation and cannot yet be quantitatively described. With the knowledge of the sign of this fragmentation contribution F, which originates from studies with simulation models, in a first step, under neglection of F, fragmentation-model independent limits for the scale parameter Λ/sub MS/, which determines the Q 2 expansion of α/sub s/ predicted by QCD, can be given. With a confidence level of 93% the result is 25 MeV$\leqq\Lambda$/ sub MS/$\leqq$400 MeV. For the coupling constant α/sub s/ this means at a c.m. energy of 35 GeV an interval of α/sub s/=0.13+-0.03. The regardment of the fragmentation contribution with the assumption F=const/$\sqrt{s}$ allows in a second step a many-parameter fit of the theoretical prediction to the observables measured at c.m. energies of 14-44 GeV. The result of the fitting calculation for the parameter Λ/sub MS/ is Λ/sub MS/=170+-40/sub -80//sup +60/ MeV, whereby the first given error gives the statistical and the second the systematical uncertainty. This Λ/sub MS/ corresponds to a value of α/sub s/ (35 GeV)=0.134/sub -0.015//sup +0/./sup 009/.

12160 **(INIS-mf—11867) Studies of hypothetical and fundamental decay properties of positronium.** Wahl, W. (Heidelberg Univ. (Germany, F.R.). Naturwissenschaftlich-Mathematische Gesamtfakultaet). May 1985. 110p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88756360/JAW.

For the solution of the CP problem in the standard theory of the strong interaction the existence of a neutral pseudoscalar boson was postulated which couples to quarks and leptons. If the mass of this so-called axion is smaller than two electron masses for orthopositronium 'o-Ps' the decay into one photon and axion is expected in concurrence to the standard decay into three photons. The detection of a monoenergetic photon would be an indication for this decay channel because the axion would only very weakly interact with matter. In the spectrum no lineshape of a monoenergetic photon is observed. From this results in dependence on the mass of a hypothetical particle and with a confidence limit of 90% for the branching ratio of o-Ps an upper limit which is in the range between 320 keV and 950 keV less than 10/sup -7/. Applied to the axion model an upper limit for the mass of the standard axion of 250 keV results. For the study of the fundamental decay properties of positronium the lifetime of o-Ps and the 3γ energy distribution of the decay quanta were measured. Furthermore the rare 4γ decay of para-positronium 'p-Ps' was searched for. The measured lifetime of o-Ps tau=141.2+-1.2ns agrees well with the theoretical value. Calculations on the 3γ energy distribution are confirmed. For the 4γ decay of p-Ps predicted by QED with a branching ratio of $\cong$ 1.5x10/sup -6/ an upper limit of 2x10/sup -5/ results. (orig./HSI).

12161 **(INP—1292/PH) Inclusive Λ/sup 0/ production and polarization in K/sup -/p interactions.** Haupt, T. (Institute of Nuclear Physics, Krakow (Poland)). 1985. 103p. NTIS (US Sales Only), PC A06/MF A01 - OSTI; INIS. Order Number DE88705291/JAW.

In this thesis a detailed analysis of inclusive production of neutral strange particles in K/sup -/p interactions at 110 GeV/c is presented. The analysis is concentrated on the Λ/sup 0/ hyperon production. About 80% of Λ/sup 0/-s is produced in the channel K/sup -/p -> Λ/sup 0/ KK-bar + anything at 110 GeV/c while at lower energies the inclusive Λ/sup 0/ production is dominated by the channel K/sup -/p -> Λ/sup 0/ + pions. Next the results of the measurement of the Λ/sup 0/ polarization are presented. These results are compared with those obtained at lower energies as well as with those coming from reactions induced by non-strange projectiles. The most striking feature of the polarization is its dependence on the transverse momentum of Λ/sup 0/, different in different channels and different hemispheres. Finally, our results are compared with predictions of models based on the quark-parton picture. 29 refs., 49 figs., 5 tabs.

12162 **(ISN—88-11) Measurement of free neutron lifetime by electron decay detection with a migration chamber.** Grivot, P. (Grenoble-1 Univ., 38 (France). Inst. des Sciences Nucleaires; Institut Laue-Langevin, 38 - Grenoble (France); Grenoble-1 Univ., 74 - Annecy (France). Lab. de Physique des Particules). Jan 1988. 158p. (In French). NTIS (US Sales Only), PC A08/MF A01. Order Number DE88756257/JAW.

In this study, the different aspects of the realization of the experimental setup are successively described: creation of a pulsed monochromatic neutron beam, design and construction of a detector for neutron decay electrons, development of electronics and of the data acquisition system, measurement of the helium-3 density in a gaseous mixture. A mechanical system called double chopper and a monochromator crystal are used to obtain neutron bursts with a length of about 28 cm and a velocity of 846 m/s. The electron detector is a time projection chamber (TPC) filled at atmospheric pressure with a helium-4 (93%), helium-3 (10/sup -5/%) and carbon dioxide (7%) mixture. The problems encountered during the data acquisition with the neutron beam and preliminary results from analysis are also presented.

12163 **(ITEF—1(1988)) Exotic baryons with isospin I=5/2 in π/sup +/p interactions.** Drutskoj, A.G.; Mikhajlichenko, V.I.; Morgunov, V.L.; Nikitin, S.Ya. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1988. 27p. (In Russian). NTIS (US Sales Only), PC A03/ MF A01 - OSTI; INIS. Order Number DE88705296/JAW.

The results of investigation of the π/sup +/p->π/sup +/ π/sup +/π/sup -/p reaction at π/sup -/-meson emission to the back hemisphere are presented. The beam pulse is 4.23 GeV/c. Production of six baryon and four meson known resonance is observed. Cross sections of quasi-two-particle reactions of baryon exchange: π/sup +/p->Δ/sup ++/(1232)rho/sup 0/, πp->Δ/sup ++/(1910)rho/sup 0/, π/sup +/p->pa/sub 1//sup +/(1270), π/ sup +/p->pπ/sub 2//sup +/(1680) are determined. Four peaks, which can be interpreted as exotic baryons E/sup +++/ with the I=5/2 isotopic spin with the accuracy being provided by the experimental statistics, are observed in reactions of baryon exchange

in the mass spectrum of the pπ/sup +/π/sup +/ system. 12 refs.; 25 figs.

12164 **(JINR-R—1-88-102) Observation of narrow diproton states in ppγ-channel.** Abdinov, O.B.; Bajramov, A.A.; Mailov, A.A.; Budagov, Yu.A.; Lomakin, Yu.F.; Flyagin, V.B.; Kharzheev, Yu.N. (AN Azerbajdzhanskoj SSR, Baku. Inst. Fiziki). (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1988. 6p. (In Russian). NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS. Order Number DE88705303/JAW.

The spectra of ppγ-combinations of particles produced in the pion-nucleus interactions at 5 GeV/c have been investigated. For the first time the dibaryons decaying on ppγ have been observed with a suifficient significance (about 5 st.deviations). The masses of structures found in the ppγ systems turned out to be close to ones observed earlier in the pp-system. 19 refs.; 3 figs.; 1 tab.

12165 **(JINR-R—1-88-120) Observation of production and decay of excited (cs-bar)-state with ~ 2790 MeV/c/sup 2/ mass in nuclear photoemulsion.** Batusov, Yu.A.; Bunyatov, S.A.; Kuznetsov, O.M. and others. (Joint Inst. for Nuclear Research, Dubna (USSR)). (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1988. 7p. (In Russian). NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS. Order Number DE88705304/JAW.

Submitted to the journal Pis'ma Zh. Ehksp. Teor. Fiz. .

During investigation of neutrino interactions with nuclei in photoemulsion an event has been registered for the first time that is interpreted as a diffractive production of the radially excited D/sub s//sup *+/-meson state with 2790+-57 MeV/c/sup 2/ mass. 9 refs.; 2 figs.; 1 tab.

12166 (JINR-R—15-87-288, pp 3-9) **Study on production of cumulative pions with large transverse momenta on nuclei.** Zarubin, P.I.; Kim, V.T. 1987. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE89780047/JAW. (CONF-8604409—).

From 3. seminar of young scientist of JINR in region of experimental physics; Dubna, USSR (1 Apr 1986).

The problem in the study of hard cumulative pion production in pA-interactions is formulated and a method permitting to solve it efficiently is suggested. It is suggested that the experiment should be conducted using a special installation for PI/sup -/ recording, which permits to operate with the ultrahigh intensity of primary beam I $\simeq$ 5 x 10/sup 11/ particles/cycle and has: a wide solid angle, a wide range of momentum recording, and provides a possibility to study angular dependence. 26 refs.; 2 tabs.

12167 **(LA-UR—88-3886) Neutrino-electron scattering at LAMPF: Large Cherenkov detector experiment.** White, D.H. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 17p. (CONF-8809223—1). NTIS, PC A03/MF A01 - OSTI. Order Number DE89003560/JAW.

From Workshop on new directions in neutrino physics; Batavia, IL, USA (14 Sep 1988).

An experiment to measure neutrino-electron scattering is described. The neutrinos are generated in a beam stop from 800 MeV protons at LAMPF. The expected precision on sin$^2\theta$/sub w/ is 1%. The experiment also gives stringent hints on neutrino oscillations and is sensitive to neutrinos from supernova collapse. 5 refs., 11 figs., 2 tabs.

12168 **(MPI-PAE/Exp.El.—190) Search for narrow resonance production in Bhabha scattering at center-of-mass energies near 1.8 MeV.** Lorenz, E.; Mageras, G.; Stiegler, U.; Huszar, I. (Max-Planck-Institut fuer Physik und Astrophysik, Muenchen (Germany, F.R.); Paul Scherrer Inst., Villigen (Switzerland)). (Max-Planck-Institut fuer Physik und Astrophysik, Muenchen (Germany, F.R.). Werner-Heisenberg-Inst. fuer Physik; Max-Planck-Institut fuer Physik und Astrophysik, Muenchen (Germany, F.R.)). May 1988. 14p. Also published in Phys. Lett., B (10 Nov 1988) v. 214(1) p. 10-13.

We have searched for narrow resonances in a fine energy scan of the Bhabha scattering cross section. The statistical sensitivity was 1.6% for center-of-mass energies between 1.62 and 1.74 MeV, and 0,8% between 1.74 and 1.89 MeV. We observe no significant structure and derive upper limits for the intrinsic width of resonances in the above energy range.

12169 **(PCCF-T—87-04) Contribution to the counting of the jet number in the reaction e/sup +/e/sup -/ -> partons -> hadrons. (Development of an algorithm).** Kherbouche, E.F. (Clermont-Ferrand-2 Univ., 63 - Aubiere (France). Lab. de Physique Corpusculaire; Clermont-Ferrand-2 Univ., 63 - Aubiere (France)). Sep 1987. 117p. (In French). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88756447/JAW.

When a quark or a gluon (Partons) are produced in a reaction, they become indirectly observable through their hadron recombination. When the energy of the quark or the gluon is very important with regard to the parton mass, hadrons are produced with a jet structure. This detected and correctly recreated jet allows us to get up to the initial Parton, and thus to the process which created it, in order to study the QCD predictions on the production of this initial parton. We used several methods of jet events analysis (geometrical methods, cluster methods...). We suggest a mathematical method on Shape Recognition, and already used in other fields. This method is based on PEANO-HILBERT scanning. This method applied to jet events generated by high-energy Monte Carlo method in LUND is less efficient than the LUCLUS method. However the jet reconstruction is relatively correct. The poor results of the P-H method are due to: the choice of space where hadrons are to be found, the definition of the surrounding of the scanning hypercubes. Another chosen space of the hadronic state might improve the results by changing the notion of surrounding of the scanning hypercubes. However this method can be applied to other fields in Physics when elements have to be gathered.

12170 **(TRI-PP—88-72) Measurements of np observables at TRIUMF.** Davis, C.A. (TRIUMF, Vancouver, British Columbia (Canada)). Sep 1988. 4p. (CONF-880983—23). NTIS (US Sales Only), PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005050/JAW.

From 8. international symposium on high energy spin physics; Minneapolis, MN, USA (12 Sep 1988).

Recent np elastic scattering measurements at TRIUMF have emphasized high precision and extension of the data base to include previously only poorly measured observables. The measurements are: A/sub oonn/, A/sub oono/, A/sub ooon/ over many angles; R/sub t/ = A/sub osso/ at one angle near 160{degree} cm; D/sub t//R/sub t/ = A/sub onno//A/sub osso/ at one angle near 160{degree} cm; A/sub oono/ zero crossing angle; and n + p $\rightarrow$ p + n differential cross section at 0{degree}; all at several energies over the TRIUMF energy range (200--500 MeV). These measurements were undertaken to improve the np phase shifts, which have yet to reach the precision of pp phase shifts, and to help resolve discrepancies in the np data set. The present data, that have been analyzed to date, constrain the $^3S_1$-$^3D_1$ mixing parameter, ϵ_1, to the lower end (about 4{degree}) of its previous range; also lower ϵ_3; and smooth out the energy variation of the $^1P_1$, $^3S_1$, and $^3D_2$ phase shifts. The measured elastic scattering observables are important in distinguishing the predictions of the modern N-N potentials needed for nuclear structure calculations. 21 refs., 3 figs., 2 tabs.

12171 **(TRI-PP—88-83) Charge symmetry breaking in the two nucleon system.** Niskanen, J.A.; Iqbal, M.J. (TRIUMF, Vancouver, British Columbia (Canada)). Sep 1988. 4p. (CONF-880983—26). NTIS (US Sales Only), PC A02/MF A01 - OSTI. Order Number DE89005060/JAW.

From 8. international symposium on high energy spin physics; Minneapolis, MN, USA (12 Sep 1988).

We review work to explain the recent TRIUMF experiment on the charge symmetry breaking observable ΔA = A/sub n/{minus}A/sub p/ in polarized np scattering. In most theoretical models nearly all of ΔA can be explained as the np mass difference effect in OPE at the zero crossing angle of the experiment, with heavy meson exchanges contributing to the angular distribution only off that angle. Also differences of the nn versus pp interaction and the reaction np $\rightarrow$ dπ^0 are shortly discussed. 24 refs., 2 figs., 2 tabs.

12172 **Measurement of D/sub s//sup +- / and D/sup +- / decays to nonstrange states.** Anjos, J.C.; Appel, J.A.; Bean, A.; Bracker, S.B.; Browder, T.E.; Cremaldi, L.M.; Elliott, J.R.; Escobar, C.O.; Estabrooks, P.; Gibney, M.C.; and others. (University of California, Santa Barbara, California 93106). *Physical Review Letters;* **62**: No. 2, 125-128(9 Jan 1989).

Using the data from Fermilab experiment 691, we have observed signals for the decays D/sub s//sup +- / and D/sup +- / →$\pi^-\pi^+\pi$/sup +- / and have analyzed these modes for the fraction due to rho$^0\pi$/sup +- / and $f_0(975)\pi$/sup +- /. In addition, we have searched for the decays D/sub s//sup +- / and D/sup +- / →$\pi^-\pi^+\pi^-\pi^+\pi$/sup +- /. Values or upper limits are reported for the relative branching fractions for all of the above decays.

12173 **Search for the charmless decays B→pp-barπ and pp-bar$\pi\pi$.** Bebek, C.; Berkelman, K.; Blucher, E.; Byrd, J.; Cassel, D.G.; Cheu, E.; Coffman, D.M.; Copie, T.; Crawford, G.; DeSalvo, R.; and others. (Cornell University, Ithaca, New York 14853; Ithaca College, Ithaca, New York 14850;). *Physical Review Letters;* **62**: No. 1, 8-11(2 Jan 1989).

From a sample of 332 000 BB-bar pairs produced in e^+e^- annihilations at the Y(4S) resonance we derive upper limits for the branching fractions for the decays B^-→pp-barπ^- and B-bar^0→pp-bar$\pi^+\pi^-$ in several final-state momentum configurations. The results do not confirm recently reported observations of charmless B decays.

12174 **Λ0 and Lambda-bar^0 production from proton-antiproton collisions at $\sqrt{s}$ = 1.8 TeV.** Banerjee, S.; Beery, P.D.; Biswas, N.N.; Bujak, A.; Carmony, D.D.; Carter, T.; Choi, Y.; Findeisen, C.; Goshaw, A.T.; Hojvat, C.; and others. (Department of Physics, Duke University, Durham, North Carolina, 27706). *Physical Review Letters;* **62**: No. 1, 12-15(2 Jan 1989).

The transverse-momentum spectra of lambdas (Λ^0,Lambda-bar^0) produced in the central region has been measured in p-barp collisions at $\sqrt{s}$ = 1.8 TeV at the Fermilab Collider. We find that the average transverse momentum of the lambdas increases more rapidly with center-of-mass energy than that of charged particles, and the ratio of lambdas to charged particles increases as a function of center-of-mass energy.

12175 **Measuring the parton content of the photon at the DESY ep collider HERA.** Drees, M.; Godbole, R.M. (Physics Department, University of Wisconsin, Madison, Wisconsin 53706). *Physical Review* [*Section*] *D: Particles and Fields;* **39**: No. 1, 169-178(1 Jan 1989).

We discuss the possibility to measure the parton, and especially gluon, content of the photon at the forthcoming DESY ep collider HERA. We first reemphasize that the production of two jets with high transverse momentum p/sub T/ is dominated by events where the photon is resolved into quarks and gluons for p/sub T/approx. <40 GeV. We then show that these "resolved" contributions, and in particular those that are initiated by a gluon from the photon, are especially important at large jet rapidities. Rapidity distributions also allow us to isolate the direct photon-gluon fusion contributions to bb-bar production. This makes it possible to use this process to determine the gluon content of the proton. However, a direct measurement of the gluon content of the photon will only be possible if the spectator jet from the photon can be detected. We find that this jet typically has an energy of 10—12 GeV and estimate its opening angle to be around 15°, which should allow for its detection.

12176 **Measurement of the D^0, D^+, and D/sub s/$^+$ meson lifetimes.** Averill, D.; Blockus, D.; Brabson, B.; Brom, J.; Jung, C.; Ogren, H.; Rust, D.R.; Derrick, M.; Kooijman, P.; Loos, J.S.; and others. (Indiana University, Bloomington, Indiana 47405). *Physical Review* [*Section*] *D: Particles and Fields;* **39**: No. 1, 123-137(1 Jan 1989).

We report measurements of the lifetimes of the D^0, D^+, and D/sub s/$^+$ (F^+) mesons produced in e^+e^- collisions at a center-of-mass energy of 29 GeV. The decay vertex distributions in the processes D^0→$K^-\pi^+$, D^+→$K^-\pi^+\pi^+$, and D/sub s/$^+$→phiπ^+ were made using a vertex chamber installed in the High Resolution Spectrometer at the SLAC storage ring PEP. The measured lifetimes are tau/sub D//sub =/ = (4.4 +- 1.0 +- 0.6) x 10/sup -13/ s, tau/sub D//sub =/ = (9.2/sub -1.3//sup +1.7/ +- 1.6) x 10/sup -13/ s, and tau/sub D//sub >//sub s//sup =/ = (3.1/sub -2.0//sup +2.4/ +- 0.5) x 10/sup -13/ s. In addition the lifetime of the B^0 meson is determined assuming that only the B^0 and not the B^- decays to a D/sup */+ meson. The B^0 is not directly observed. The lifetime tau/sub B//sub =/ is estimated indirectly to be (8.2/sub -3.7//sup +5.7/ +- 2.7) x 10/sup -13/ s.

12177 **Measurement of the reaction K^+n/sub up-arrow/→$K^+\pi^-$p at 5.98 and 11.85 GeV/c using a transversely polarized deuteron target.** de Lesquen, A.; van Rossum, L.; Svec, M.; Babou, M.; Bystricky, J.; Cozzika, G.; Dobrowolski, T.; Ducros, Y.; Fujisaki, M.; Gaidot, A.; and others. (Departement de Physique des Particules Elementaires, Centre d'Etudes Nucleaires de Saclay, Gif-sur-Yvette, France). *Physical Review* [*Section*] *D: Particles and Fields;* **39**: No. 1, 21-44(1 Jan 1989).

In an experiment carried out at the CERN Proton Synchrotron and using the CERN polarized deuteron target, the reaction K^+n/sub up-arrow/→$K^+\pi^-$p was measured in the region -t = 0.1—1.0 (GeV/c)^2 and m($K^+\pi^-$) = 0.812—0.972 GeV at incident momenta of 5.98 and 11.8 GeV/c. The experiment yields the m and t dependence of 14 linearly independent spin-density-matrix elements describing the coherent production of $K^+\pi^-$ states with dimeson spins J = 0 and J = 1. This first measurement of the KN→KπN reaction on a polarized target enables us to study experimentally pion production on the level of production amplitudes. Although the mass dependence of partial cross sections averaged over nucleon spins is smooth, we observe large and systematic structures in the moduli squared of individual nucleon transversity amplitudes which reveal an unexpected but essential role of nucleon spin in the pion production process. Our polarization data suggest the possibility of a new state I = (1/2 0/sup ++/(860) with a width of 20—40 MeV. At present we consider this conclusion as only tentative. The predictions of the additive quark model relating K^+n/sub up-arrow/→K/sup */^{0}p and p/sub up-arrow/p→Δ/sup ++/n are well satisfied at 6 GeV/c. Our results emphasize the need for a systematic study of single-pion production in a new generation of dedicated experiments with spin at the recently proposed high-intensity hadron facilities.

12178 **Acceleration of polarized protons to 22 GeV/c and the measurement of spin-spin effects in p/sub up-arrow/+p/sub up-arrow/→p+p.** Khiari, F.Z.; Cameron, P.R.; Court, G.R.; Crabb, D.G.; Fujisaki, M.; Gialas, I.; Hansen, P.H.; Hejazifar, M.E.; Krisch, A.D.; Lin, A.M.T.; and others. (Randall Laboratory of Physics, The University of Michigan, Ann Arbor, Michigan 48109). *Physical Review* [*Section*] *D: Particles and Fields;* **39**: No. 1, 45-85(1 Jan 1989).

Accelerating polarized protons to 22 GeV/c at the Brookhaven Alternating Gradient Synchro- tron required both extensive hardware modifications and a difficult commissioning process. We had to overcome 45 strong depolarizing resonances to maintain polarization up to 22 GeV/c in this strong-focusing synchrotron. At 18.5 GeV/c we measured the analyzing power A and the spin-spin correlation parameter A/sub n//sub n/ in large- P/sub perpendicular/^{2} proton-proton elastic scattering, using the polarized proton beam and a polarized proton target. We also obtained a high-precision measurement of A at P/sub perpendicular/^{2} = 0.3 (GeV/c)^2 at 13.3 GeV/c. At 18.5 GeV/c we found that A/sub n//sub n/ = (-2 +- 16)% at P/sub perpendicular/^{2} = 4.7 (GeV/c)^2, where it was about 60% near 12 GeV at the Argonne Zero Gradient Synchrotron. This sharp change suggests that spin-spin forces may have a strong and unexpected energy dependence at high P/sub perpendicular/^{2}.

12179 Experimental study of muon pairs produced by 252-GeV pions on tungsten. Conway, J.S.; Adolphsen, C.E.; Alexander, J.P.; Anderson, K.J.; Heinrich, J.G.; Pilcher, J.E.; Possoz, A.; Rosenberg, E.I.; Biino, C.; Greenhalgh, J.F.; and others. (Enrico Fermi Institute and Department of Physics, The University of Chicago, Chicago, Illinois 60637). *Physical Review [Section] D: Particles and Fields;* **39**: No. 1, 92-122(1 Jan 1989).

We present the results of a study of muon pairs with invariant masses greater than 4.05 GeV/c^2 produced in high-energy pion-nucleon interactions. The production cross section together with the inferred pion and nucleon structure functions are reported and compared with other experiments and with QCD predictions. The transverse-momentum distributions are also presented. Finally, the full angular distribution in cosθ and phi is given as a function of mass, Feynman x, and transverse momentum. Longitudinal photon polarization is seen in the lower portion of the mass range at high x/sub π/. This result is compared with a higher-twist model.

12180 Meson production in two-photon collisions. Cooper, S. (Physics Department and Laboratory for Nuclear Science, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139). *Annual Review of Nuclear Science;* **38**: No. 1, 705-750(1988).

In this review I concentrate on the contributions of two-photon physics to meson spectroscopy. These include correcting the two-photon width of the eta meson (and its total width, which is derived from Γ/sub $\Gamma\gamma$//sub $\gamma\gamma$/) and providing the only available measurements of the $\gamma\gamma$ couplings of most of the heavier ground-state quarkonium mesons. (AIP)

12181 Direct measurements of neutrino mass. Robertson, R.G.H.; Knapp, D.A. (Physics Division, Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Annual Review of Nuclear Science;* **38**: No. 1, 185-216(1988).

This review critically examines direct laboratory efforts to determine the masses of the neurinos. By 'direct' we mean methods that do not require for their success the nonconservation of lepton number or of lepton family number. The methods considered are essentially kinematic in nature The important constraints set by cosmology and by the neutrino signals observed from the supernovae Shelton, SN1987a, are also kinematic but must perforce be excluded here. Similarly, no discussion of theoretical questions is made beyond that necessary to interpret the data. (AIP)

12182 Particle composition in hadronic jets in e^+e^- annihilation. Hofmann, W. (Lawrence Berkeley Laboratory, University of California, Berkeley, California 94720). *Annual Review of Nuclear Science;* **38**: No. 1, 279-322(1988).

This review summarizes the main results on inclusive spectra and particle composition of hadronic jets in e^+e^- annihilation in the 10–40 GeV energy range. (AIP)

12183 Hadronic and radiative decays of the J/psi. Hitlin, D.G.; Toki, W.H. (California Institute of Technology, Pasadena, California 91125). *Annual Review of Nuclear Science;* **38**: No. 1, 497-532(1988).

This review primarily emphasizes the spectroscopic aspect of the study of J/psi decays. We begin with a discussion of the radiative decay of the J/psi to the eta/sub c/, proceed to direct decays of the J/psi to hadrons and then focus on radiative decays of the J/psi to those resonances, iota/eta(1460), the θ/f_2(1720), the ξ(2230), and the myriad vector- vector resonances that may provide additional glueball candidates. (AIP)

6452 Particle Interactions And Properties - Theoretical

REFER ALSO TO CITATION(S) 12141, 12171, 12215, 12216, 12225, 12237, 12240, 12285

12184 (BNL—41990) Radiative corrections to top and bottom production at collider energies. Dawson, S. (Brookhaven National Lab., Upton, NY (USA)). Oct 1988. Contract AC02-76CH00016. 5p. (CONF-8808145—15). NTIS, PC A02/MF A01 - OSTI. Order Number DE89004560/JAW.

From Meeting of the Division of Particles and Fields of the American Physical Society (APS); Storrs, CT, USA (15 Aug 1988).

We discuss the results of a full calculation of the QCD O(α_s/sup s/) radiative corrections to the differential cross section for the production of a heavy quark pair. Numerical results are presented for bottom and top production in p{bar p} collisions at {square←root}s = 1.8 TeV. 2 refs., 2 figs.

12185 (BONN-HE—88-08) QCD sum rule calculation of the Banti B mixing matrix element <anti B/sup 0/vertical strokeO/sub $\Delta B=2$/vertical strokeB/sup 0/>. Reinders, L.J.; Yazaki, S. (Bonn Univ. (Germany, F.R.). Physikalisches Inst.; Tokyo Univ. (Japan). Dept. of Physics). (Bonn Univ. (Germany, F.R.). Physikalisches Inst.; Tokyo Univ. (Japan). Dept. of Physics). Apr 1988. 13p. Also published in Phys. Lett., B (22 Sep 1988) v. 212(2) p. 245-250.

Using QCD sum rules we calculate the Banti B mixing parameter B. We find B = 0.95+-0.10 or B/sup 1/2/f/sub B/ = 165+-15MeV, with f/sub B/ the leptonic decay constant of the B meson.

12186 (DOE/ER/03956—T4) [Elementary particle interactions]: Progress report. Close, F.E. (Tennessee Univ., Knoxville (USA). Dept. of Physics). 1988. Contract AS05-76ER03956. 8p. NTIS, PC A02/MF A01 - OSTI. Order Number DE89004682/JAW.

This paper briefly discusses high energy physics research in inelastic scattering of leptons from hadron and nuclear targets; nuclear dependence of parton distributions; and shadowing of nuclear structure functions. (LSP)

12187 (DOE/ER/03956—T5) [Elementary particle interactions]: Progress report for Task B1, 1987--1988. Ward, B.F.L. (Tennessee Univ., Knoxville (USA). Dept. of Physics). 1988. Contract AS05-76ER03956. 6p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004681/JAW.

This paper discusses high energy physics topics such as perturbative QCD, fragmentation in hadronization, quarks, and SU_2 {times} U_1 radiative correction. 7 refs. (LSP)

12188 (DOE/ER/40150—50) Pseudo-scalar πN coupling and relativistic proton-nucleus scattering. Gross, F.; Maung, K.M.; Tjon, J.A.; Townsend, L.W.; Wallace, S.J. (Southeastern Universities Research Association, Newport News, VA (USA). Continuous Electron Beam Accelerator Facility). 1987. Contract AC05-84ER40150. 11p. (CEBAF-PR—88-010). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005551/JAW.

Relativistic p-^{40}Ca elastic scattering observables are calculated using relativistic NN amplitudes obtained from the solution of a two-body relativistic equation in which one particle is kept on its mass-shell. Results at 200 MeV are presented for two sets of NN amplitudes, one with pure pseudo-vector coupling for the pion and another with a 25% admixture of pseudo-scalar coupling. Both give a very good fit to the positive energy on-shell NN data. Differences between the predictions of these two models (which are shown to be due only to the differences in their corresponding negative energy amplitudes) provide a measure of the uncertainty in constructing Dirac optical potentials from NN amplitudes. 12 refs., 2 figs.

12189 (IFVE-ONF—88-43) Superphysics at UNK collider. Kereselidze, A.R.; Liparteliani, A.G.; Sokolov, A.A.; Volkov, G.G. (Tbilisskij Gosudarstvennyj Univ. (USSR); Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1988. 14p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705259/JAW.

The theoretical incompleteness of standard model and the way of going beyond frames on the basis of supersymmetry are considered. The most important directions of experimental researches at the colliders of a new generation are given. Theoretical

estimates of masses of supersymmetrical particles in the framework of N=1 supergravity obtained from compactification of the popular E/sub 8/xE/sub 8/ superstring theories are presented. The experimental search for supersymmetrical particles at the UNK pp-collider ($\sqrt{s}$=6 TeV) is performed. 11 refs.; 5 figs.; 2 tabs.

12190 **(IFVE-ONF—88-68) Lepton radiative decays in supersymmetric standard model.** Volkov, G.G.; Liparteliani, A.G.; Devidze, G.G.; Tkebuchava, F.G. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij; Tbilisskij Gosudarstvennyj Univ. (USSR)). (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1988. 18p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705260/JAW.

Submitted to te journal Sov. J. Nucl. Phys. .

Radiative decays of charged leptons l/sub i/->l/sub j/γ(γ/sup */) have been discussed in the framework of the supersymmetric generalization of the standard model. The most general form of the formfactors for the one-loop vertex function is written. Decay widths of the mentioned radiative decays are calculated. Scalar lepton masses are estimated at the maximal mixing angle in the scalar sector proceeding from the present upper limit for the branching of the decay μ->eγ. In case of the maximal mixing angle and the least mass degeneration of scalar leptons of various generations the following lower limit for the scalar electron mass m/sub e-tilde/>1.5 TeV has been obtained. The mass of the scalar neutrino is <0(1) GeV. Scalar neutrino may be also heavy >0(1) TeV, in case the charged calibrino is lighter than the scalar neutrino. The result obtained sensitive to the choice of the lepton mixing angle in the scalar sector, namely, in decreasing the value sin 2/sup θ/ by an order of magnitude, the limitation on the scalar electron mass may decrease more than 3 times. In the latter case the direct observation of electrons at the e/sup +/e/sup -/-collider (1x1 TeV) becomes available. 14 refs.; 1 fig.

12191 **(IFVE-OTF—87-48) Prospects of the future ep colliders.** Alekhin, S.I.; Boos, Eh.Eh.; Borodulin, V.I.; Dzhikiya, G.V.; Slabospitskij, S.R.; Smirnov, A.Yu.; Sultanov, S.F. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij; AN Azerbajdzhanskoj SSR, Baku. Inst. Fiziki). (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1987. 16p. (In Russian). NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705262/JAW.

The possibilities of ep colliders with $\sqrt{}$=1.1 and 2.4 TeV to investigate new physics at the l~10/sup -17/ cm have been considered. UNK with linear electron accelerator enables to investigate the mechanism of spontaneous symmetry breaking in the standard model, interactions conditioned by new gauge bosons, the properties if excited leptons and quarks of the first family, the structure of contact interactions, predicted by preon models, the properties of SUSY-partners of electrons and light quarks. 11 refs.; 10 figs.; 6 tabs.

12192 **(INIS-mf—11868) 'Relativistic' quark model for mesons with flavour-independent potential.** Kroesen, G. (Bonn Univ. (Germany, F.R.). Mathematisch-Naturwissenschaftliche Fakultaet). 14 Sep 1987. 83p. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88756361/JAW.

On the base of the Bethe-Salpeter equation in instantaneous approximation a unified model for the mass spectrum of the mesons was designed. The 'relativistic' structure of the Bethe-Salpeter equation allows a natural inclusion of the spin dependences and an extension of the model to small quark masses. The model contains as essential property two potential contributions where one represents the one-gluon exchange while the other represents the confinement potential. The annihilation of qanti q into gluons was not regarded. The spectrum and the amplitudes of the Bethe-Salpeter equation were solved approximatively in numerical way for the lowest states. The free parameters of the model were determined by a fit of the spectrum to a wellknown part of the meson spectrum. The results yield even at small quark masses a quantitatively good picture for all meson families. The result shows that the spectra of the heavy and light mesons can be described by a flavor-independent potential which contains 5 free parameters. Both the internal spin dependent structure and the absolute position of the families can so correctly be described. Especially the position of the D, D/sub s/, and B states and the position of the uanti u, danti d states can be simultaneously described by a constant C in the long-range part of the potential. The constant C is thereby essentially determined by the splitting between the Y family and the B family repectively PSI and D family. The /sup 3/S/sub 1-//sup 3/D/sub 1/ respectively the /sup 3/P/sub 2/-/sup 3/F/sub 2/ configuration mixing was regarded. The results show that this mixing is negligibly small. (orig./HSI).

12193 **(INP—1238/PH) Ground state baryons in the unitarised quark model.** Zenczykowski, P. (Institute of Nuclear Physics, Krakow (Poland)). (Institute of Nuclear Physics, Krakow (Poland); Uniwersytet Jagiellonski, Krakow (Poland)). Feb 1984. 42p. (TPJU—6/84). NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705276/JAW.

Hadronic self-energy effects for the ground state baryons (B) are discussed within the framework of the unitarised quark model. The contributions from all pseudoscalar (P) and vector (V) mesons in the self-energy B->PB'->B, B->VB'->B loops are taken into account. It is assumed that all mass splittings (barring the strange "quark mass" difference) are due to the unitarity effects only. Under this assumption a good description of the mass pattern of the ground state baryons is achieved with only a weak (and consistent with experiment) deviation from SU(6)/sub W/ symmetry for hadronic vertices. 19 refs., 4 figs., 3 tabs.

12194 **(INP—1280/PH) Indication for a broad J/sup PC/ = 2/sup ++/ meson at 840 MeV produced in the reaction PI/sup -/p->PI/sup +/PI/sup -/n at high chemical bondtchemical bond.** Rybicki, K.; Sakrejda, I. (Institute of Nuclear Physics, Krakow (Poland)). 1985. 33p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705283/JAW.

The reaction PI/sup -/p->PI/sup +/PI/sup -/n has been extensively studied at 17.2 GeV/c and 63 GeV/c. A partial wave analysis shows a fairly broad (~250 MeV) resonance at about 840 MeV. This object, already visible in moments of the angular distribution,is produced in the D wave with helicity m=2 via unnatural exchange. The cross section for the reaction PI/sup -/p->D/sub 2U/(840)n is only by an order of magnitude lower than that rho(770) and falls like p/sub LAB//sup -2.1+-0.3/. We have not been able to explain this object by systematic experimental effects like acceptance and/or N/sup */ reflections; neither is the nature of the resonance (if real) clear to us. 17 refs., 12 figs., 5 tabs.

12195 **(INP—1282/PH) Baryon spectroscopy: symmetries, symmetry breaking and hadronic loops.** Zenczykowski, P. (Institute of Nuclear Physics, Krakow (Poland)). 1985. 101p. NTIS (US Sales Only), PC A06/MF A01 - OSTI; INIS. Order Number DE88705285/JAW.

The problem of hadronic loop effects in baryon spectroscopy is thoroughly discussed. It is argued that such effects very likely constitute the dominant contribution to the observed splitting and mixing pattern of the (56,0/sup +/) and (70,1/sup -/) baryon multiplets. In particular, this dominance is demonstrated in the original Isgur-Karl-Koniuk model of baryons, in which hadronic loops are shown to provide an explanation for at least 2/3 of the observed size of splittings, both for the ground-state and excited baryons. The unitarity-induced mixing angles in the (70,1/sup -/)-multiplet are also shown to be in good agreement with experiment. For the ground-state baryons the formula relating Σ-Λ and Δ-NU mass differences - as originally derived by de Rujula, Georgi and Glashow from the single gluon exchange-is obtained from the hadronic loop effects as well. This (and other) results are derived after taking into account a complete set of symmetry-related hadronic loops. Consideration of such a complete set of symmetry-related processes is shown to be crucial in restoring proper symmetry properties of the calculated spectrum. 74 refs., 10 figs., 4 tabs.

12196 **(JINR-E—2-88-122) Magnetic moments of baryons and radiative decays of lowest meson resonances.** Gerasimov, S.B. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1988. 14p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705300/JAW.

Submitted to the 8. International conference on the problems of quantum field theory, Alushta, USSR, 10-16 Oct 1987.

Magnetic moments of the octet baryons are considered in the frameworks of phenomenological sum rules based on the general groundwork of quark models that include relativistic effects and nonadditive corrections due to the pion exchange currents. The relations between the u, d, s-quark magnetic moments thus obtained are then used for an analysis of the vector and pseudoscalar meson radiative decays. The parameters related to the quark content of the eta and eta'-mesons are compared with the corresponding quantities extracted from the measured hadronic J/PSI-decays. 39 refs.

12197 **(JINR-E—2-88-133) Interaction of relativistic deuterons with nucleons.** Dolidze, M.G.; Lykasov, G.I. (Tbilisskij Gosudarstvennyj Univ. (USSR); Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1988. 14p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705301/JAW.

Submitted to the journal Z. Phys. .

The processes of the interaction of fast deuterons with nucleons dN -> pX, when the proton is scattered at a large angle in N-N c.m.s. are analyzed. There the wave function of a relativistic deuteron in dynamics of the light cone is used. It is shown, that as in the processes of the deuteron fragmentation type, it is necessary to take into account, the graphs of rescattering and absorption of the π-meson by a deuteron nucleon, as well as a non-nucleon, quark, degree of freedom in the deuteron. The comparison of the theoretical calculations with the experimental data is performed. 26 refs.; 3 figs.

12198 **(JINR-E—6-88-121) Meson exchange second class currents and the neutrino mass in the muon capture by light nuclei.** Katkhat, Ch.L. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1988. 12p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705302/JAW.

Submitted to the 38. Conference on nuclear spectroscopy and atomic nucleus structure, Baku, 1988.

Influence of the Kubodera-Delorme-Rho model parameters (zeta and ξ), the scalar form factor (F/sub s/) and the muonic neutrino rest mass (m/sub $\nu\mu$/) on the asymmetry coefficient (α/sub $\mu\nu$/) of neutrino emission with respect to the muon spin orientation in the muon capture by light nuclei is analyzed. It is shown, that the mass m/sub $\nu\mu$/, the parameters of zeta and ξ, and the form factor F/sub s/ may be estimated by studying the coefficient α/sub $\mu\nu$/ in O -> O, Gamov-Teller, and mixed transitions, respectively. 30 refs.; 1 fig.; 4 tabs.

12199 **(JINR-R—2-88-113) About applicability of the one-pion exchange model to description of pp-interactions in 33-resonance region.** Suslenko, V.K.; Gajsak, I.I.; Kolerov, G.I. (Radievyj Inst., Leningrad (USSR)). (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1988. 10p. (In Russian). NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS. Order Number DE88705305/JAW.

Submitted to the session of nuclear physics division, USSR Academy of Sciences, Moscow, 1988.

A brief outline of complete differential analysis for an example of "two into three" type reaction, pp->npπ/sup +/, is presented, in particular, a detailed comparison of experimental data of any order of differentiality for this reaction with all presentations of one-pion exchange model (OPEM) is developed. The applicability of the OPEM to describe strong interaction reactions in intermediate energy region of 0.6-1 GeV is shown and "pion-nucleon form factor" is extracted as a result of the analysis proposed. 22 refs.; 7 figs.

12200 **Lepton-pair production in proton-nucleon collisions as a means of testing the standard electroweak model.** Hwang, W.P.; Garvey, G.T.; Moss, J.M.; Peng, J.C. (Department of Physics, National Taiwan University, Taipei, Taiwan 10764, Republic of China). *Physical Review* [*Section*] *D: Particles and Fields;* **39**: No. 1, 209-220(1 Jan 1989).

We use the standard Glashow-Salam-Weinberg SU(2)/sub L/ x U(1) electroweak theory to calculate the charge asymmetry expected for lepton-pair production in proton-nucleon collisions at various center-of-mass energies. Specifically, we discuss the prospect of measuring charge asymmetry as a means to determine the electroweak mixing parameter $\sin^2\theta$/sub W/, using a proton-beam energy of around 800 GeV. As motivated by the observation that an additional (nonstandard) gauge boson in a low-energy theory appears naturally in the E_6 x E_8 superstring studies, we also adopt an extended SU(2)/sub L/ x U(1) x U(1) electroweak model. To study manifestations of the nonstandard gauge boson, we consider a fixed-target experiment at a few TeV as well as for a proton-antiproton or proton-proton collider experiment in the few-TeV range. In particular, the behavior of charge asymmetry near the standard Z^0 pole is investigated as a possible means to determine the Z^0-Z'^0 mixing parameter sinphi. The possibility of a direct search for the nonstandard gauge boson Z'^0 at Fermilab Tevatron energies is also briefly discussed.

12201 **WWZ, ZZZ, and WWγ production at e^+e^- colliders.** Barger, V.; Han, T.; Phillips, R.J.N. (Physics Department, University of Wisconsin, Madison, Wisconsin 53706). *Physical Review* [*Section*] *D: Particles and Fields;* **39**: No. 1, 146-155(1 Jan 1989).

We discuss the prospects for the detection of WWZ, ZZZ, and WWγ events at a future e^+e^- supercollider with c.m. energy 0.35—2.0 TeV. These modes provide tests of triple and quartic gauge-boson couplings. WWZ and ZZZ modes also provide tests of a neutral Higgs boson H if its mass is in the range 200—600 GeV; there are especially large enhancements in the ZZZ channel. For an annual integrated luminosity of 10 fb/sup -1/ at optimal incident energies about a thousand events would be produced per annum in each of the WWZ and WWγ channels, plus about ten ZZZ events in the absence of Higgs-boson enhancements. Of order 20% of the WWZ and ZZZ final states and 30% of the WWγ final states are in principle fully reconstructible. We present dynamical distributions with and without H effects.

12202 **$B\to\mu^+\mu^-$ in the two-Higgs-doublet model.** Hewett, J.L.; Nandi, S.; Rizzo, T.G. (Ames Laboratory and Department of Physics, Iowa State University, Ames, Iowa 50011). *Physical Review* [*Section*] *D: Particles and Fields;* **39**: No. 1, 250-256(1 Jan 1989).

The rare decay $B\to\mu^+\mu^-$ is studied within the context of the two-Higgs-doublet extension of the standard model. We show that for a reasonable range of model parameters, the charged-Higgs-scalar contribution exceeds the conventional contributions from the standard model. For the process B/sub s/$\to\mu^+\mu^-$, branching fractions approx. >10/sup -8/ are possible in this scenario. For the process $Z\to bq\text{-bar}+b\text{-}barq$, we find the charged-Higgs-boson contribution leads to branching fractions approx. >10/sup -6/.

12203 **Analysis of muon decay with lepton-number-nonconserving interactions.** Langacker, P.; London, D. (Deutsches Elektronen-Synchrotron DESY, Notkestrasse 85, D-2000, Hamburg 52, Federal Republic of Germany). *Physical Review* [*Section*] *D: Particles and Fields;* **39**: No. 1, 266-273(1 Jan 1989).

We analyze muon decay using the most general local, derivative-free, Lorentz-invariant, lepton-number-nonconserving interactions. We show that, neglecting neutrino masses, there is a one-to-one correspondence between the coupling constants in the lepton-number-conserving case and combinations of coupling constants in the lepton-number-violating case; i.e., it is not possible, even in principle, to test lepton-number conservation in muon decay if the final neutrinos are massless and are not observed. Using these relations, we are able to use previous analyses of (lepton-number-conserving) muon and inverse muon decay to put stringent limits on certain combinations of parameters. If fine-tuned cancellations are

not allowed, these limits constrain the individual coupling constants. We discuss to what extent it is directly tested that the (left-handed) neutrino emitted in muon decay is the same as that which is produced in π/sub μ/$_2$ decay.

12204 **Application of the bootstrap statistical method to the tau-decay-mode problem.** Hayes, K.G.; Perl, M.L.; Efron, B. (Stanford Linear Accelerator Center, Stanford University, Stanford, California 94309). *Physical Review [Section] D: Particles and Fields;* **39**: No. 1, 274-279(1 Jan 1989).

The bootstrap statistical method is applied to the discrepancy in the one-charged-particle decay modes of the tau lepton. This eliminates questions about the correctness of the errors ascribed to the branching-fraction measurements and the use of Gaussian error distributions for systematic errors. The discrepancy is still seen when the results of the bootstrap analysis are combined with other measurements and with deductions from theory. But the bootstrap method assigns less statistical significance to the discrepancy compared to a method using Gaussian error distributions.

12205 **Effective electromagnetic form factor of the neutrino.** Degrassi, G.; Sirlin, A.; Marciano, W.J. (Department of Physics, New York University, New York, New York 10003). *Physical Review [Section] D: Particles and Fields;* **39**: No. 1, 287-294(1 Jan 1989).

The conceptual difficulties affecting the definition of the neutrino electromagnetic form factor are briefly reviewed in the context of the standard model. It is then shown that the radiative corrections Δ/sup (//sup ν//sup ;//sup l//sup)/(q^2) and Δ/sup (//sup ν//sup ;//sup h//sup)/(q^2) relevant to ν-lepton and ν-hadron scattering in the renormalization scheme in which $\sin^2\theta$/sub W/equivalent1-m/sub W/^{2}/m/sub Z/^{2}, can be separated into two finite and gauge-invariant parts. One part Δ/sup (//sup ν//sup)/(q^2) is target independent and the associated function f(q^2)equivalent-$q^2\Delta$/sup (//sup ν//sup)/ (q^2)/(2m/sub W/^{2}) can be interpreted as an effective electromagnetic form factor of the neutrino in the framework of the low-energy theory derived from the standard model at invariant mass scales $<<$m/sub W/^{2}. The observability of this quantity and its dependence on the top-quark mass and the neutrino flavor are discussed. Updated estimates of the hadronic contributions to Δ/sup (//sup ν//sup)/(q^2) are given. A strategy to search for ν structure beyond the standard model is outlined.

12206 **Orbital angular momentum, spin fractions, and scenarios for the proton's spin-weighted parton distributions.** Ramsey, G.P.; Qui, J.; Richards, D.; Sivers, D. (Department of Physics, Loyola University, Chicago, Illinois 60626). *Physical Review [Section] D: Particles and Fields;* **39**: No. 1, 361-364(1 Jan 1989).

New data from the European Muon Collaboration (EMC) on the spin-spin asymmetry in deep-inelastic lepton-proton scattering suggests that the total spin carried by valence quarks in a polarized proton may be approximately canceled by a strong negative polarization of the sea of q-barq pairs. The evolution in Q^2 of the fraction of proton spin carried by gluons depends on the initial spin fractions and it is possible to avoid the introduction of large orbital angular momentum by adopting a "hybrid" quark-Skyrme picture of the proton suggested by the EMC results.

12207 **Geometrical branching model: Phenomenology with jets.** Chen, W.R.; Hwa, R.C. (Institute of Theoretical Science and Department of Physics, University of Oregon, Eugene, Oregon 97403). *Physical Review [Section] D: Particles and Fields;* **39**: No. 1, 179-186(1 Jan 1989).

The geometrical branching model with jets is used to analyze the data on σ/sub el/,σ/sub tot/,$<n>$, and the higher moments of particle multiplicity in hadron-hadron collisions at all available energies. The eikonal formalism is used as the framework to combine the soft and hard components of the multiparticle production process. The soft component of the eikonal function is assumed to be geometrical scaling even in the presence of the hard component. We show in the context of the model that the geometrical size of a hadron ceases to increase in the energy region of the CERN Spp-barS collider. The production of jets is shown to be responsible not only for the continued increase of the inelastic cross section, but also for the breaking of the Koba-Nielson-Olesen scaling.

12208 **Effect of jet production on the multiplicity dependence of average transverse momentum.** Wang, X.; Hwa, R.C. (Institute of Theoretical Science and Department of Physics, University of Oregon, Eugene, Oregon 97403). *Physical Review [Section] D: Particles and Fields;* **39**: No. 1, 187-194(1 Jan 1989).

The geometrical branching model for multiparticle production is used to study the multiplicity dependence of the average transverse momentum $<$p/sub T/$>$/sub n/ of charged particles produced in the central region of pp-bar collisions. The production of jets is shown to be responsible for the increase of $<$p/sub T/$>$/sub n/ with multiplicity. We demonstrate that beyond the plateau region that follows the initial steep rise the jets cause $<$p/sub T/$>$/sub n/ to have a further increase at even higher multiplicities. The physical basis of this "ledge" effect is discussed and contrasted from an earlier speculation based on phase transition.

12209 **Fourth-generation-quark production at the Superconducting Super Collider.** Dawson, S.; Godfrey, S. (Physics Department, Brookhaven National Laboratory, Upton, New York 11973). *Physical Review [Section] D: Particles and Fields;* **39**: No. 1, 221-231(1 Jan 1989).

The production of fourth-generation quarks at the Superconducting Super Collider is studied concentrating on event signatures resulting from the single-lepton and two-lepton decay modes. We find that events with multijets (n/sub jet/$\geq$3) and one or two high-p/sub T/ leptons are good signals for heavy-quark production for quark masses up to 600 GeV. In addition, we also found that the total transverse energy of an event is useful for distinguishing between heavy-quark production and the top-quark background.

12210 **Spectra of the transitions $\Upsilon(nS)\rightarrow\Upsilon(mS)\pi^+\pi^-$.** Belanger, G.; DeGrand, T.; Moxhay, P. (Laboratoire de Physique Nucleaire, Universite de Montreal, Case Post. 6128, Montreal, Quebec, Canada H3C 3J7). *Physical Review [Section] D: Particles and Fields;* **39**: No. 1, 257-265(1 Jan 1989).

The spectra of the transitions $\Upsilon(nS)\rightarrow\Upsilon(mS)\pi^+\pi^-$ are discussed, taking account of multipole-expansion corrections as well as of final-state $\pi^+\pi^-$ and $\Upsilon\pi$ interactions. The inclusion of a four-quark resonance in the $\Upsilon\pi$ channel, as suggested by Voloshin, together with $\pi^+\pi^-$ final-state interactions, may explain the presence of two peaks in the $\Upsilon(3S)\rightarrow\Upsilon(1S)\pi^+\pi^-$ spectrum. Further tests of this model are proposed.

12211 **Exotic phases and hadronic matter and their astrophysical application.** Alcock, C.; Olinto, A. (Lawrence Livermore Laboratory, Institute of Geophysics and Planetary Physics, Livermore, California 94550). *Annual Review of Nuclear Science;* **38**: No. 1, 161-184(1988).

The exotic phase of hadronic matter, i.e., strange matter, an absolute stable phase of quark matter is discussed. The phenomenological consequences of strange matter being the true ground state of the strong interaction are discussed. (AIP)

12212 **CERN collider results and the standard model.** Bagnaia, P.; Ellis, S.D. (Experimental Physics Division, CERN, CH-1211 Geneva 23, Switzerland). *Annual Review of Nuclear Science;* **38**: No. 1, 659-704(1988).

The last decade has seen substantial progress in our understanding of the interactions that characterize the physical universe on very small distance scales. This development has been strongly stimulated by use of large, high energy particle accelerators to probe this kinematic regime. The theoretical structure of our understanding is embodied in a quantum field theory with a hierachy of gauge symmetries that is referred to as the Standard Model. The many exciting and technically impressive that have tested and verified this experimental structure are well exemplified by those performed at the proton-antiproton Collider at the European laboratory, CERN, in Switzerland. With essentially all of the basic elements of the Standard Model experimentally confirmed and while we await the beginning of enhanced experimental programs at CERN

and at the corresponding laboratory, Fermilab, in the United States, it is appropriateto review the results from CERN and their place in the Standard Model. (AIP)

12213 **Electroweak symmetry breaking: Unitarity, dynamics, and experimental prospects.** Chanowitz, M.S. (Lawrence Berkeley Laboratory, University of California, Berkeley, California 94720). *Annual Review of Nuclear Science;* **38**: No. 1, 323-420(1988).

A review of what is known about the unexplained mechanism that breaks the electroweak symmetry and thereby gives mass to the W and Z gauge bosons while leaving the photon massless is given. Symmetry, unitarity, technicolor, supersymmetry, higgs sector dynamics, and experimental status and prospects are discussed. (AIP)

6453 Particle Invariance Principles And Symmetries

REFER ALSO TO CITATION(S) 12171, 12202, 12203, 12232, 12233, 12236, 12238, 12241, 12387

12214 **(BONN-HE—88-01) Branching rules for unitary representations of Virasoro and super-Virasoro algebras at c = 1.** Baake, M. (Bonn Univ. (Germany, F.R.). Physikalisches Inst.). Jan 1988. 16p. Also published in J. Math. Phys. (Aug 1988) v. 29(8) p. 1753-1757.

The branching rules for unitary highest weight representations of Virasoro and super-Virasoro algebras which contain a subalgebra with central charge c = 1 are presented. These rules are useful for identifying points of higher symmetry in two-dimensional critical systems with c = 1 and for the analysis of a defected Ising chain.

12215 **Spontaneous breaking of Lorentz symmetry in string theory.** Kostelecky-acute-accent, V.A.; Samuel, S. (Physics Department, Indiana University, Bloomington, Indiana 47405). *Physical Review* [*Section*] *D: Particles and Fields;* **39**: No. 2, 683-685(15 Jan 1989).

The possibility of spontaneous breakdown of Lorentz symmetry in string theory is explored via covariant string field theory. A potential mechanism is suggested for the Lorentz breaking that may be generic in many string theories.

12216 **Uniqueness of quark and lepton representations in the standard model from the anomalies viewpoint.** Geng, C.Q.; Marshak, R.E. (TRIUMF, 4004 Wesbrook Mall, Vancouver, British Columbia, Canada V6T 2A3). *Physical Review* [*Section*] *D: Particles and Fields;* **39**: No. 2, 693-696(15 Jan 1989).

The uniqueness of the Weyl representations of the standard gauge group is reexamined. We find that, prior to spontaneous breaking of the electroweak subgroup, the minimal Weyl representations and their charges are uniquely determined by insisting on all three known chiral gauge anomaly-free conditions in four dimensions: (1) cancellation of triangular anomalies; (2) absence of the global SU(2) anomaly; and (3) cancellation of the mixed-gauge-gravitational anomaly. The uniqueness question for the left-right-symmetric group and the simple (grand-unified-theory) group are discussed from the anomalies viewpoint.

6454 Field Theory

REFER ALSO TO CITATION(S) 12100, 12175, 12210, 12215, 12216, 12500

12217 **(BNL—42021) Group theory and lattice gauge fields.** Creutz, M. (Brookhaven National Lab., Upton, NY (USA)). Sep 1988. Contract AC02-76CH00016. 11p. (CONF-8806105—3). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004897/JAW.

From 17. international colloquium on group theoretical methods in physics; Quebec, Canada (27 Jun 1988).

Lattice gauge theory, formulated in terms of invariant integrals over group elements on lattice bonds, benefits from many group theoretical notions. Gauge invariance provides an enormous symmetry and powerful constraints on expectation values. Strong coupling expansions require invariant integrals over polynomials in group elements, all of which can be evaluated by symmetry considerations. Numerical simulations involve random walks over the group. These walks automatically generate the invariant group measure, avoiding explicit parameterization. A recently proposed overrelaxation algorithm is particularly efficient at exploring the group manifold. These and other applications of group theory to lattice gauge fields are reviewed in this talk. 17 refs.

12218 **(BNL—42022) Simulating lattice QCD at finite density.** Gocksch, A. (Brookhaven National Lab., Upton, NY (USA)). 1988. Contract AC02-76CH00016. 4p. (CONF-8808145—16). NTIS, PC A02/MF A01 - OSTI. Order Number DE89004898/JAW.

From Meeting of the Division of Particles and Fields of the American Physical Society (APS); Storrs, CT, USA (15 Aug 1988).

A new method of simulating systems with a complex action is applied to lattice QCD at finite density. At infinite gauge coupling we obtain a phase diagram which, in nice agreement with mean field theory, gives a critical value of the chemical potential unrelated to the baryon mass. At the same time we demonstrate explicitly the failure of the quenched approximation. 8 refs.

12219 **(BONN-HE—88-13) Finite-size effects in the SU(2) Higgs model: A numerical investigation.** Evertz, H.G.; Marcu, M.; Katznelson, E.; Lauwers, P.G. (Hamburg Univ. (Germany, F.R.). 2. Inst. fuer Theoretische Physik). (Bonn Univ. (Germany, F.R.). Physikalisches Inst.; Hamburg Univ. (Germany, F.R.). 2. Inst. fuer Theoretische Physik). Jul 1988. 13p. (CONF-8805175—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756344/JAW.

From Lattice Higgs workshop; Tallahassee, FL, USA (16 May 1988).

We present new results from a Monte Carlo simulation of the Higgs region of the SU(2) gauge theory with a fundamental scalar matter field. To investigate the model at $\lambda = \infty$, $\beta = 2.4$ and 2.7, and κ close to the phase transition, three different lattice sizes were used: 8/sup 3/ x 24, 10/sup 3/ x 24 and 12/sup 3/ x 24. The finite size effects, which are by no means negligible, are discussed in detail.

12220 **(BONN-HE—88-14) New separable expansion for the two-body problem.** Haberzettl, H. (Bonn Univ. (Germany, F.R.). Physikalisches Inst.). Jul 1988. 31p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756345/JAW.

We derive a new separable expansion of the two-body T matrix which represents the T matrix as a series of diagonal separable terms. The representation is exact half-on-shell at all energies even when truncated to one single term; moreover, the truncated expansion satisfies the full off-shell unitarity relation. The approach does not take recourse to some complete set of functions but rather uses properties of the Lippmann-Schwinger equation itself to arrive at the expansion. It is based on the W-matrix representation of the two-body T matrix introduced by Bartnik, Haberzettl, and Sandhas. That representation provides a splitting of the T matrix in one single separable term which contains all bound state poles and scatttering cuts and in a nonsingular, real remainder which vanishes half-on-shell. The method presented here yields a separable expansion of this remainder in which all its properties are preserved term by term. Any given n-term approximation can easily be refined to an (n+1)-term expansion by simply adding a new term. At each stage the amount of additional numerical work is constant. The method is applicable to any kind of short range potential, local, nonlocal or energy dependent.

12221 **(DOE/ER/40219—T1) [Theoretical elementary particle physics research with emphasis on unified theories of particle interactions].** Ng, Y.J. (North Carolina Univ., Chapel Hill (USA). Dept. of Physics and Astronomy). 1988. Contract FG05-85ER40219. 11p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number TI89005268/JAW.

This paper briefly discusses string theory, QED, and violations of Pauli-principle. (LSP)

12222 **(GSI—88-62(prepr.)) Localized bound states of fermions interacting via massive vector bosons.** Ionescu, D.C.; Reinhardt, J.; Mueller, B.; Greiner, W.; Soff, G. (Frankfurt Univ. (Germany, F.R.). Inst. fuer Theoretische Physik). (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.); Frankfurt Univ. (Germany, F.R.). Inst. fuer Theoretische Physik). Nov 1988. 34p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756498/JAW.

A model for composite consisting of fermions with internal degrees of freedom interacting via intermediate vector bosons (IVB) is constructed. We find highly localized, low-mass bound states in the Hartree-Fock approximation. We investigate the dependence of these states as function of the coupling constant and vector boson mass. In the limit of infinite vector boson mass the interaction is described by Fermi-type contact forces.

12223 **(IFT-P—21/88) Hamiltonian formulation of anomaly free chiral bosons.** Abdalla, E.; Abdalla, M.C.B.; Devecchi, F.P.; Zadra, A. (Sao Paulo Univ., SP (Brazil). Inst. de Fisica). (Instituto de Fisica Teorica, Sao Paulo, SP (Brazil)). 1988. 9p. NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS. Order Number DE88705256/JAW.

Starting out of an anomaly free Lagrangian formulation for chiral scalars, which a Wess-Zumino Term (to cancel the anomaly), we formulate the corresponding hamiltonian problem. Ther we use the (quantum) Siegel invariance to choose a particular, which turns out coincide with the obtained by Floreanini and Jackiw.

12224 **(INP—1275/PH) On the relation between Galilean, Poincare and Euclidean field equations.** Kapuscik, E. (Institute of Nuclear Physics, Krakow (Poland)). 1985. 16p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705279/JAW.

A new kind of relation between Galilean, Poincare and Euclidean field equations is demonstrated. 5 refs.

12225 **(LA-UR—88-4285) Short times and short distances in nuclear and particle physics: A pedagogical review.** West, G.B. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 27p. (CONF-880758—7). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005468/JAW.

From Workshop on nuclear and particle physics on the light cone; Los Alamos, NM, USA (18 Jul 1988).

The formalism relevant to deep inelastic processes in both non- relativistic and relativistic systems is reviewed with an emphasis on scaling and its violations. In the former case we show how a systematic expansion in $1/q^2$ (q being the momentum transfer) can be derived which delineates the incoherent scattering from bound state and potential corrections. We demonstrate how this exact many-body non-relativistic formalism corresponds to the light-cone operator product expansion in quantum field theory. As examples, scaling in liquids, nuclei and nucleons is discussed with emphasis on the EMC effect, shadowing and the relationship to the photo absorption limit. 8 refs., 10 figs.

12226 **(NBI-HE—88-19) U(1) Higgs model in an external electromagnetic field.** Damgaard, P.H.; Heller, U.M. (Niels Bohr Inst., Copenhagen (Denmark); California Univ., Santa Barbara (USA). Inst. for Theoretical Physics). (Niels Bohr Inst., Copenhagen (Denmark); Niels Bohr Inst., Copenhagen (Denmark); California Univ., Santa Barbara (USA). Inst. for Theoretical Physics). 5 Apr 1988. 31p. (NSF-ITP—88-27i). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756523/JAW.

An external electromagnetic field is coupled to the lattice-regularized U(1) Higgs model. We study the phase diagram of this model by both analytical and numerical techniques for different values of the external field strength tensor. The results are compared with expectations based on the analogy with superconducting systems, as described by the phenomenological Ginzburg-Landau theory.

12227 **(NBI-HE—88-21) Two- and three-loop amplitudes in covariant loop calculus.** Roland, K. (Niels Bohr Inst., Copenhagen (Denmark)). Apr 1988. 20p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756524/JAW.

We study 2- and 3-loop vacuum-amplitudes for the closed bosonic string. We compare two sets of expressions for the corresponding density on moduli space: One, based on the covariant Reggeon loop calculus (where modular invariance is not manifest). The other, based on analytic geometry. We want to prove identity between the two sets of expressions. Quite apart from demonstrating modular invariance of the Reggeon results, this would in itself be a remarkable mathematical feature. Identity is established to 'high' order in some moduli and exactly in others. The expansions reveal an essentially number-theoretical structure. Agreement is found only by exploiting the connection between the 4 Jacobi θ-functions and number theory.

12228 **(SFB—237-14-Prepr.) Stability of ground states in nonlinear classical field theory.** Stubbe, J. (Bochum Univ. (Germany, F.R.). Sonderforschungsbereich 237 - Unordnung und Grosse Fluktuationen). Apr 1988. 70p. Bochum Univ. (Germany, F.R.). Sonderforschungsbereich 237 - Unordnung und Grosse Fluktuationen.

We develop a stability theory for abstract Hamiltonian systems arising from many models in classical field theories: Their solitary wave solutions are characterized by minimization principles (ground states) and their energy functional has the so-called scale-covariance property. In addition the systems may be invariant under one-parameter groups of isometric operators. In addition the systems may be invariant under one-parameter groups of isometric operators. We present sharp stability conditions for ground state solitary waves. Our theory applies to a large series of examples. In particular we are able to give a more general study of the stability properties of solitary waves of nonlinear Klein-Gordon equations and nonlinear Schroedinger equations.

12229 **(SFB—237-15-Prepr.) Dirichlet forms, quantum fields and stochastic quantisation.** Albeverio, S.; Roeckner, M. (Bochum Univ. (Germany, F.R.). Sonderforschungsbereich 237 - Unordnung und Grosse Fluktuationen; Bielefeld Univ. (Germany, F.R.). Forschungszentrum Bielefeld-Bochum-Stochastik (BiBoS); Bochum Univ. (Germany, F.R.). Sonderforschungsbereich 237 - Unordnung und Grosse Fluktuationen). (Bielefeld Univ. (Germany, F.R.). Forschungszentrum Bielefeld-Bochum-Stochastik (BiBoS); Bochum Univ. (Germany, F.R.). Sonderforschungsbereich 237 - Unordnung und Grosse Fluktuationen). Apr 1988. 26p. Bochum Univ. (Germany, F.R.). Sonderforschungsbereich 237 - Unordnung und Grosse Fluktuationen.

In this paper we continue our study of classical Dirichlet forms on topological vector spaces. Our main object here is to describe some new applications of our results to Euclidean quantum field theory. (orig./HSI).

12230 **(SFB—237-28-Prepr.) Some new developments concerning Dirichlet forms, Markov fields and quantum fields.** Albeverio, S. (Bochum Univ. (Germany, F.R.). Fakultaet fuer Mathematik; Bielefeld Univ. (Germany, F.R.). Forschungszentrum Bielefeld-Bochum-Stochastik (BiBoS)). (Bochum Univ. (Germany, F.R.). Sonderforschungsbereich 237 - Unordnung und Grosse Fluktuationen; Bielefeld Univ. (Germany, F.R.). Forschungszentrum Bielefeld-Bochum-Stochastik (BiBoS)). Nov 1988. 11p. Bochum Univ. (Germany, F.R.). Sonderforschungsbereich 237 - Unordnung und Grosse Fluktuationen.

We present some new developments in the theory of infinite dimensional diffusions and Dirichlet forms, with applications to generalized random fields and quantum fields. New results on the global Markov property and the uniqueness of Gibbs states associated with quantum fields in two space-time dimensions are also presented. Moreover we discuss recent results on group-valued Markovian vector random fields in four space-time dimensions and give a remark on strings and fields onRiemannian surfaces in connection with probability on infinite dimensional manifolds.

12231 Schroedinger-picture field theory in Robertson-Walker flat spacetimes. Guven, J.; Lieberman, B.; Hiiil, C.T. (Center for Theoretical Physics, Laboratory for Nuclear Science Department of Physics, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139). *Physical Review* [*Section*] *D: Particles and Fields;* **39**: No. 2, 438-451(15 Jan 1989).

A Schroedinger formulation of a free scalar field propagating in Robertson-Walker flat spacetimes is presented. Gaussian wave functionals which describe homogeneous, isotropic quantum states are considered. Several identities relating the real and imaginary parts of the Gaussian width are derived. Covariant conservation of the stress tensor is demonstrated using these relations. The formalism is applied in detail to reproduce known results in a de Sitter background.

12232 Covariant BRS quantization of the ten-dimensional N = 1 Brink-Schwarz superparticle. Aratyn, H.; Ingermanson, R. (Department of Physics, University of Illinois at Chicago, Box 4348, Chicago, Illinois 60680). *Physical Review* [*Section*] *D: Particles and Fields;* **39**: No. 2, 503-508(15 Jan 1989).

We perform the covariant Becchi-Rouet-Stora quantization of the N = 1 Brink-Schwarz superparticle in ten dimensions. The key ideas used are (1) the Batalin-Fradkin formalism for second-class constraints, (2) nonsquare vielbeins relating spinor indices to internal SO(8) indices, and (3) the special properties of Γ matrices in ten dimensions. Our work generalizes Eisenberg and Solomon's solution of the N = 2 case to N = 1.

12233 Unsuppressed fermion-number violation at high temperature: An O(3) model. Mottola, E.; Wipf, A. (Theoretical Division, T-8, Mail Stop B285, Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Physical Review* [*Section*] *D: Particles and Fields;* **39**: No. 2, 588-602(15 Jan 1989).

The O(3) nonlinear σ model in 1+1 dimensions, modified by an explicit symmetry-breaking term, is presented as a model for baryon- and lepton-number violation in the standard electroweak theory. Although arguments based on the Atiyah-Singer index theorem and instanton physics apply to the model, we show by explicit calculations that the rate of chiral fermion-number violation due to the axial anomaly is entirely unsuppressed at sufficiently high temperatures. Our results apply to unbroken gauge theories as well and may require reevaluation of the role of instantons in high-temperature QCD.

12234 Lower-bound renormalization group for gauge-Higgs systems. Callaway, D.J.E. (Department of Physics, The Rockefeller University, 1230 York Avenue, New York, New York 10021-6399). *Physical Review* [*Section*] *D: Particles and Fields;* **39**: No. 2, 612-615(15 Jan 1989).

The highly accurate Kadanoff lower-bound renormalization group for spin systems is generalized to models with local gauge symmetry. As an example it is applied to the Z_2 gauge-Higgs theory. The two critical exponents of the model are, respectively, predicted exactly and with 0.1% accuracy by a simple analytic calculation. The application of the generalized method to more complicated gauge groups in arbitrary spacetime dimension is described.

12235 Overrelaxation and mode coupling in σ models. Heller, U.M.; Neuberger, H. (Institute for Theoretical Physics, University of California, Santa Barbara, California 93106). *Physical Review* [*Section*] *D: Particles and Fields;* **39**: No. 2, 616-622(15 Jan 1989).

An exact overrelaxation algorithm for nonlinear σ models is presented and practically implemented. Using a new method of analysis the mode-mode coupling mechanism underlying overrelaxation is clearly exhibited. In one dimension our numerical results provide evidence that the critical exponent z is equal to unity.

12236 Variational-cumulant expansion in lattice gauge theory at finite temperature. Tan, C.; Zheng, X. (Department of Physics, Brown University, Providence, Rhode Island 02912). *Physical Review* [*Section*] *D: Particles and Fields;* **39**: No. 2, 623-635(15 Jan 1989).

A variational-cumulant expansion method in lattice gauge theory at finite temperature is developed as a systematic analytical method. As an example, the order-parameter Polyakov line $\langle L \rangle$ for the SU(2) gauge system is calculated to fourth order. The result is encouraging and the possibility of a second-order phase transition is clearly seen.

12237 Finite-temperature QCD with intermediate-large quark masses. Kogut, J.B.; Sinclair, D.K. (High Energy Physics Division, Argonne National Laboratory, Argonne, Illinois 60439). *Physical Review* [*Section*] *D: Particles and Fields;* **39**: No. 2, 636-642(15 Jan 1989).

Hybrid simulations of lattice QCD with four flavors of staggered quarks were performed on a $12^3 \times 4$ lattice for quark masses of 0.1, 0.2, 0.4, and 0.8 (lattice units). The order parameters were measured near the finite-temperature transition. No clear signal of a first-order transition was seen.

12238 Biased Monte Carlo algorithms on unitary groups. Creutz, M.; Gausterer, H.; Sanielevici, S. (Physics Department, Brookhaven National Laboratory, Upton, New York 11973). *Physical Review* [*Section*] *D: Particles and Fields;* **39**: No. 2, 689-692(15 Jan 1989).

We introduce a general updating scheme for the simulation of physical systems defined on unitary groups, which eliminates the systematic errors due to inexact exponentiation of algebra elements. The essence is to work directly with group elements for the stochastic noise. Particular cases of the scheme include the algorithm of Metropolis et al., overrelaxation algorithms, and globally corrected Langevin and hybrid algorithms. The latter are studied numerically for the case of SU(3) theory.

12239 Study of an overrelaxation method for gauge theories. Adler, S.L.; Bhanot, G.V. (The Institute for Advanced Study, Princeton, New Jersey 08540). *Physical Review Letters;* **62**: No. 2, 121-124(9 Jan 1989).

We study the overrelaxation algorithm developed by one of us (S.A.) for the SU(2) gauge theory in four dimensions. We find improvement in the decorrelation time for the plaquette by a factor of 2 to 3. However, our results suggest that the Monte Carlo application of overrelaxation behaves quite differently from the classical differential-equation analog. In particular, the optimum value of the overrelaxation parameter ω may depend on what order parameter one measures. In addition, there are order parameters that do not appear to improve by overrelaxation.

12240 Bose-Einstein correlations in e^+e^- collisions. Juricic, I.; Goldhaber, G.; Gidal, G.; Abrams, G.; Amidei, D.; Baden, A.R.; Boyer, J.; Butler, F.; Carithers, W.C.; Gold, M.S.; and others. (Lawrence Berkeley Laboratory and Department of Physics, University of California, Berkeley, California 94720). *Physical Review* [*Section*] *D: Particles and Fields;* **39**: No. 1, 1-20(1 Jan 1989).

Four data sets collected with the Mark II detector during its operation at the SPEAR and PEP e^+e^- storage rings at SLAC are used to study the Bose-Einstein correlation between pairs and triplets of like-sign charged pions. The data sets represent four different regions of energy available for hadron production: the J/psi at $\sqrt{s}$ = 3.095 GeV, typical hadronic energy of ≃5 GeV in two-photon events, and annihilation in the energy regions $\sqrt{s}$ = 4—7 GeV above the J/psi, and $\sqrt{s}$ = 29 GeV. The Bose-Einstein correlation is studied as a function of Q^2, the four-momentum difference squared of the pair, and of $Q_3{}^2$, an analogous quantity defined for triplets. After corrections for Coulomb effects and pion misidentification, pair analyses indicate a nearly full Bose-Einstein enhancement ($\lambda \simeq 1$) in the J/psi and the two-photon data, and about half the maximum value in the two higher-energy data sets. The pair analysis parameter r lies within a band of +- 0.1 fm around 0.7 fm and is essentially the same for all four data sets. Pion triplet analyses give consistent results for the triplet parameters λ_3 and r_3. In an attempt to investigate the shape of the pion source, we also study the Bose-Einstein correlation in pion pairs using two-dimensional distributions in components of Q^2.

12241 Chiral-symmetry constraints on the critical temperature in QCD. Cleymans, J.; Kocic, A.; Scadron, M.D. (Department of Physics, University of Arizona, Tucson, Arizona 85721). *Physical Review [Section] D: Particles and Fields;* **39**: No. 1, 323-328(1 Jan 1989).

We study the restoration of chiral symmetry at finite temperatures in QCD. We focus on the role light particles play in disordering the system and compute the critical temperature in the linear σ model, the Nambu—Jona-Lasinio model, and in the nonperturbative one-gluon-exchange approximation in QCD. In all three cases we obtain T/sub c/ = 2f/sub π/≃180 MeV, which might be a model-independent result.

12242 Resonant pair production in strong electric fields. Cornwall, J.M.; Tiktopoulos, G. (Department of Physics, University of California, Los Angeles, California 90024). *Physical Review [Section] D: Particles and Fields;* **39**: No. 1, 334-339(1 Jan 1989).

We show that strong classical electric fields with certain kinds of space-time variation can create e^+e^- pairs which are strongly resonant in energy and momentum. These resonance effects are peculiar to spin (1/2, and are allowed because of the unconventional structure of a "unitarity" relation governing the pair-production process. This relation is a physical expression of the Klein paradox. The general principles are illustrated with exact solutions of idealized examples.

12243 Curvature form and solutions of nonlinear models. Tanaka, K. (Department of Physics, The Ohio State University, Columbus, Ohio 43210). *Journal of Mathematical Physics (New York);* **30**: No. 1, 172-174(Jan 1989).

Several equations of motions of bosonic two-dimensional nonlinear models are noted that emerge from the requirement that the curvature two-form $\Omega = 0$. This information is used to obtain solutions of these equations.

65 PHYSICS II

12244 (IPNO-RA—1987) Annual report of the Institute of Nuclear Physics of the Universite de Paris-Sud (Orsay). (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire). 1988. 104p. (In French). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88756158/JAW.

Experimental and theoretical research in nuclear physics is described. Experimental work includes ground states and low energy excited states; high excitation energy nuclear states; heavy ion collision phenomena; intermediate energy nuclear physics; radiochemistry; and interdisciplinary studies of atomic physics and ion interactions. Theoretical studies include few-nucleon systems; properties of nuclear matter; nuclear collisions; nuclear physics at intermediate energies; effective Lagrangians and quark models; high energy hadronic physics; superstrings; high spins, and gravity; astrophysics; statistical physics and chaotic systems; relativistic quantum mechanics; and mathematical physics.

6510 Nuclear Physics

REFER ALSO TO CITATION(S) 11660, 12145, 12166, 12297, 12314

12245 (BNL—41985) [Historical development of the field of hypernuclei]: Concluding talk. Chrien, R.E. (Brookhaven National Lab., Upton, NY (USA)). 1988. Contract AC02-76CH00016. 26p. (CONF-8809143—5). NTIS, PC A03/MF A01 - OSTI. Order Number DE89003572/JAW.

From Hypernuclear and low-energy kaon physics; Padova, Italy (12 Sep 1988).

This paper briefly discusses progress in low energy kaon physics and hypernuclear physics. Certain kaon reactions are discussed and future possible accelerator experiments are described. (LSP)

12246 (CONF-880546—40) Some personal reflections. Smith, A.B. (Argonne National Lab., IL (USA)). 1988. Contract W-31109-ENG-38. 3p. NTIS, PC A02 - OSTI. Order Number DE89003978/JAW.

From International conference on nuclear data for science and technology; Mito, Japan (30 May 1988).

This paper analyzes data for fission-energy and fusion-energy development. Neutron reactions with uranium and plutonium are discussed in particular. Instrumentation is also reviewed. (LSP)

12247 (DOE/ER/40405—T1) Nuclear structure studies at intermediate energies: Interim progress report, August 1987 through August 1988. Hintz, N.M. (Minnesota Univ., Minneapolis (USA). School of Physics and Astronomy). Aug 1988. Contract FG02-88ER40405. 81p. NTIS, PC A05/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005326/JAW.

This report contains papers on nuclear structure studies. The topics of some of the papers discussed in this report are: recoil free Δ production; low lying magnetic states; Coulomb-nuclear polarimeter; comparison of Dirac and non relativistic IA; measurements of A/sub LL/ in {rvec p}{rvec p} elastic; π + ^{208}Pb; /sup 206,207,208/Pb density differences; search for dibaryon resonances; and effective mass corrections to p + X.

12248 (JINR-R—3-88-106) Spectroscopic possibilities of the method for summation of coinciding pulse amplitudes at neutron radiative capture. Boneva, S.T.; Vasil'eva, Eh.V.; Popov, Yu.P.; Sukhovoj, A.M.; Khitrov, V.A. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics). 1988. 14p. (In Russian). NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705307/JAW.

Submitted to the organizing committee of the conference on nuclear spectroscopy and nuclear structure, Baku, 1988.

The possibility is analyzed to study decay schemes of compound states of complex nuclei by the method of summation of amplitudes of coinciding pulses from two Ge(Li) detectors. At least 100-150 cascades from 150-250 observed in the experiment are shown to be placed in the scheme of an arbitrary complex nucleus by fixing the final cascade level, by considerable suppression of the coincidence detection background and fine separation of multiplets in spectra of a single Ge(Li) detector. The reliability of the schemes can be estimated quantitatively by means of the mathematical modelling. The method is demonstrated to allow obtaining the spectroscopic information at E/sup */≦4 MeV excitation energies. 17 refs.; 2 tabs.

12249 (LBL—26110) Pioneering the nuclear age. Seaborg, G.T. (Lawrence Berkeley Lab., CA (USA)). Sep 1988. Contract AC03-76SF00098. 50p. (CONF-8810114—2). NTIS, PC A04/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004793/JAW.

From Symposium on transuranium elements today and tomorrow: properties, prospects, problems; Karlsruhe, F.R. Germany (26 Oct 1988).

This paper reviews the historical aspects of nuclear physics. The scientific aspects of the early transuranium elements are discussed and arms control measures are reviewed. 11 refs., 14 figs. (LSP)

12250 (NEANDC(E)—292-U-Vol.3) Annual progress report on nuclear data 1987. Hansen, H.H. (ed.). (Commission of the European Communities, Geel (Belgium). Central Bureau for Nuclear Measurements). Oct 1988. 57p. (INDC(EUR)—022/G). NTIS (US Sales Only), PC A04/MF A01; 1; GPO Dep. Order Number DE89003774/JAW.

In 1987 the efforts for the improvement of the set of standard neutron cross-sections and other quantities selected within the INDC/NEANDC Standard File continued. Widths of TKE- and mass- distributions in the fission of ^{235}U as a function of neutron energy and variation of these distributions as function of the resonances and their quantum numbers can be successfully described on the basis of a three exit channel fission model. In the field of nuclear data for fission technology effort was concentrated on European requests in the NEA High Priority Request List. In the subthermal neutron energy region the measurements of {eta} of ^{235}U previously reported were corrected for multiple scattering in a more complete manner, and first fission cross-section measurements were performed at the Very Cold Neutron Source of ILL Grenoble. An ex-

perimental method for the determination of efficiencies and response functions of capture detectors, when applied to neutron capture measurements, is successful in reproducing the transmission results of the 1.15 keV resonance in ^{56}Fe, and resolves the discrepancy which initiated the NEANDC Task Force. In the area of nuclear data for fusion technology, the measurements aim at an improvement of relevant data for neutron transport calculations in the blanket which contains lithium as tritium breeder material and for prediction of gas production. Also tritium production cross-sections for ^{9}Be in the energy range from threshold to 20 MeV were measured, in collaboration with KFA Juelich. In the field of metrology for neutron flux and dose CBNM participated in a comparison, organized by BIPM, to check the usefulness of the two spheres, technique at neutron energies of 2.5 and 14.7 MeV for neutron fluence determination.

6511 Experimental Techniques

REFER ALSO TO CITATION(S) 11650

12251 **(AD-A—198521/7/XAB) Demonstration of the feasibility of the tuning and simulation of nuclear radiation. Annual summary report, 1 January-31 December 1987.** Collins, C.B. (Texas Univ., Richardson (USA). Center for Quantum Electronics and Applications). 31 Jan 1988. 35p. (UTD-XXUV—87). NTIS, PC A03/MF A01.

This project concerns the demonstration of the feasibility of the tuning and perhaps even stimulation of nuclear radiation. Theory has indicated that anti-Stokes Raman upconversion of intense but conventional long-wavelength sources of radiation produced by scattering from isomeric states of nuclear excitation could lead to significant sources of tunable gamma radiation characterized by the natural Moessbauer widths of the lines. This would result in lines with sub-Angstrom wavelengths and widths of a few MHz. Whether or not these processes can reach threshold depends upon the resolution of basic issues lying in an interdisciplinary region between quantum electronics and nuclear physics that have not been previously addressed. It was the purpose of this work to study these issues experimentally.

12252 **(DOE/ER/40343—2) Research in experimental nuclear physics: Progress report, April 1, 1988--March 31, 1989.** Moore, C.F. (Texas Univ., Austin (USA). Dept. of Physics). Nov 1988. Contract FG05-87ER40343. 14p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005018/JAW.

This report summarizes the work carried out by personnel from the University of Texas at Austin at the Los Alamos Clinton P. Anderson Meson Physics Facility (LAMPF) during the calendar year 1987 under grant AS05-87ER40343 between The University of Texas at Austin and the United States Department of Energy. The research activities involved experiments done with the Energetic Pion Channel and Spectrometer (EPICS), the Low Energy Pion Channel (LEP), the Pion and Particle Physics Channel (P^3), and the High Resolution Spectrometer (HRS). A brief overview of work supported by this grant is given. This report contains a list of abstracts of papers reported at scientific meetings, a list of invited papers, and a list of published papers and preprints. These papers summarize experiments undertaken in this grant period and indicate the work accomplished by the participants in this program of medium energy nuclear physics research. Much of the experimental work that has been attempted during the period covered by this report has either been published or submitted for publication. Also included is a list of the recent proposals on which we have participation at LAMPF, and a list of personnel who have participated in this research program.

6512 Nuclear Properties And Reactions, A=1-5, Experimental

12253 **(CEA-N—2528) Cross sections for the /sup /3 He (e,e'p) reaction-proton momentum distributions in /sup /3 He from 300 to 600 MeV/c.** Marchand, C.; Bernheim, M.; Dunn, P.C. and others. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Service de Physique Nucleaire a Haute Energie). Sep 1988. 13p. (In French). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756232/JAW.

Electron scattering cross sections for the /sup /3 He (e,e'p) reaction have been measured at Saclay Linear Accelerator for recoil momenta between 300 and 600 MeV/c and up to 90 MeV missing energy. Taking care of final state interactions and meson exchange currents, the proton momentum distributions in /sup /3 He are obtained in plane wave impulse approximation (PWIA) from 318 to 600 MeV/c for the pd break-up channel and from 290 to 515 MeV/c for the ppn channel. The experiment is described in Phys. Rev. Lett. 60 (1988) 1703 and herein is reported the complete set of obtained data.

12254 **(FRCEA-TH—82) Conception and operation of a 10 kCi liquid tritium target for the study of tritium nucleus by electron diffusion: /sup 3/H(e,e).** Juster, F.P. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Physique Nucleaire; Paris-11 Univ., 91 - Orsay (France)). Jun 1986. 272p. (In French). NTIS (US Sales Only), PC A12/MF A01. Order Number DE88756440/JAW.

We describe the conception and operation of an experimental setup, specially suited for the study of the nuclear structure of tritium by elastic electron scattering at intermediate energy. The experiment has been conducted at the ALS 700 MeV electron linac (Saclay, France). The radioactive nature of tritium has led to the design of a new target, suited for handling reliably ten kilocuries of tritium (one gram). The tritium is contained in three sealed envelopes. Initially a high pressure gas (23 bars) at room temperature, the tritium is cooled down to liquefaction by thermal conduction through a solid, without breaking any seal. The beam path and the scattered trajectories cross thin metallic windows. Additional protection, during the presence of personnel, is provided by a heavy container, remotely operated. Any leak in the containement vessels is detected by changes in pressure and/or temperature gauges, monitored by two independent processors. These processors handle the operation of the outer container, the beam switching and the spare venting system. No tritium leak has been detected during a total six-week run. The tritium liquefies in a cylindrical target, 5 cm long and 1 cm in diameter. A beam of 10 microamperes, in the 200-700 MeV, has been measured. The charge and magnetic form factors of tritium have been measured up to a momentum transfer of 31.3 fm/sup -2/.

6513 Nuclear Properties And Reactions, A=6-19, Experimental

12255 **Deuteron formation in the reaction /sup 12/C(e,e'd)/sup 10/B/sub T//sub //sub = /$_1$.** Ent, R.; Berman, B.L.; Blok, H.P.; van den Brand, J.F.J.; Briscoe, W.J.; Jans, E.; Kramer, G.J.; Lanen, J.B.J.M.; Lapikas, L.; Norum, B.E.; and others. (Natuurkundig Laboratorium, Vrije Universiteit, 1007 MC Amsterdam, The Netherlands). *Physical Review Letters;* **62**: No. 1, 24-27(2 Jan 1989).

In the reaction /sup 12/C(e,e'd)/sup 10/B the lowest-lying T = 1 state in /sup 10/B is found to be as strongly excited as the T = 0 ground state of /sup 10/B, although the transition to the T = 1 state is isospin forbidden for direct deuteron knockout. A mechanism of integration of a p-n pair in a relative T = 1 state into a deuteron is proposed to explain this result. This new proposed mechanism is consistent with both the observed purely transverse character of the transition and the momentum-transfer dependence of the cross section.

12256 **Inelastic electron scattering from /sup 13/C.** Millener, D.J.; Sober, D.I.; Crannell, H.; O'Brien, J.T.; Fagg, L.W.; Kowalski, S.; Williamson, C.F.; Lapikas, L. (Brookhaven National Laboratory, Upton, New York 11973). *Physical Review [Section] C: Nuclear Physics;* **39**: No. 1, 14-46(Jan 1989).

A detailed investigation of the excited states of /sup 13/C below 10 MeV excitation energy by means of high-resolution electron scattering at momentum transfers between 0.4 and 2.4 fm/sup -1/ has been performed. Additional data taken for excitation energies between 10 and 22 MeV are also selectively discussed. Up to an excitation energy of 12 MeV the data are compared with the results of a shell-model calculation which uses the full $0(h/2\pi)\omega$ and $1(h/2\pi)\omega$ model spaces together with effective one-body transition operators.

12257 **Electroexcitation of the Δ resonance in the (e,e'p) reaction.** Baghaei, H.; Bertozzi, W.; Blomqvist, K.I.; Finn, J.M.; Flanz, J.; Hyde-Wright, C.E.; Kalantar-Nayestanaki, N.; Lourie, R.W.; Nelson, J.; Sapp, W.W.; and others. (Department of Physics and Laboratory for Nuclear Science, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139). *Physical Review [Section] C: Nuclear Physics;* **39**: No. 1, 177-180(Jan 1989).

The /sup 12/C(e,e'p) reaction at the delta resonance has been measured for protons detected parallel to the momentum transfer at two kinematical situations: at the maximum and the low-energy-loss side of the peak. The cross section was measured for missing energies up to 320 and 220 MeV, respectively. In the missing energy spectrum two distinct structures are observed, which correspond to multinucleon knockout and quasifree pion production processes. In addition, there is a remnant of the quasifree knockout process.

6514 Nuclear Properties And Reactions, A=20-38, Experimental

12258 **(DOE/ER/40326—4) Neutron cross section measurements using the Oak Ridge Electron Linear Accelerator: Performance report, July 1987--June 1988.** Winters, R.R. (Denison Univ., Granville, OH (USA)). Jul 1988. Contract FG02-87ER40326. 22p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89003671/JAW.

This paper briefly describes neutron cross sections for the following isotopes: ^{20,22}Ne, ^{86}Kr, ^{89}Y, ^{208}Pb, ^{56}Fe, ^{189}Os, ^{86,87,88}Sr, ^{122,123,124,125,126}Te, and ^{40}Ar. 6 refs., 10 figs., 2 tabs.

12259 (RCNP-P—97, pp 110-115) **Structure of /sub Λ//sup 20/Ne hyper nucleus.** Sakuda, Toshimi. (Miyazaki Univ. (Japan)). 1988. (In Japanese). NTIS (US Sales Only), PC A08/MF A01. Order Number DE88780018/JAW. (CONF-8712121—).

From Workshop on clustering aspects in nuclear structures and nuclear reactions; Ibaraki, Japan (14 Dec 1987).

Advanced studies on the hyper nucleus have revealed various new phenomena that are caused by hyperons. The present report describes some new phenomena found in the /sub Λ//sup 20/Ne (= /sup 19/Ne+Λ) system. The positive parity of /sup 19/Ne is associated with a shell like structure of (sd)/sup 3/. A state of negative parity appears at a very low energy of 0.28 MeV. This is attributed to the development of the α + /sup 15/O cluster structure. If Λ is added to this system, the ground state is at the l/sup -1/ level though Λ enters the S/sub 1/2/ orbit. The present approach is based on an orthogonal condition model that combines the two channels of (/sup 3/He + /sup 16/O + Λ) and (α + /sup 15/O + Λ). The model space is represented by the product of /sup 19/Ne and Λ. Investigation shows that changes in the distance between /sup 3/He + /sup 16/O clusters are small at positive parity. Another investigation is made on experimental approaches to demonstrating the negative-parity ground state. In (K/sup -/, π/sup -/) reaction, strong excitation occurs at low parity because of small momentum transfer, while the momentum transfer is large in (π/sup -/, K/sup +/) reaction, leading to strong excitation at positive parity. Another approach uses the decay of /sub Λ//sup 20/Ne to study the stability of the ground state. The delayed γ-decay strongly reflects the parity of the ground state. (Nogami, K.).

12260 **Emission times in low-energy heavy-ion reactions by particle-particle correlations.** DeYoung, P.A.; Gordon, M.S.; Lu, X.q.; McGrath, R.L.; Alexander, J.M.; de Castro Rizzo, D.M.; Vaz, L.C. (Departments of Physics and Chemistry, State University of New York at Stony Brook, Stony Brook, New York 11794). *Physical Review [Section] C: Nuclear Physics;* **39**: No. 1, 128-131(Jan 1989).

Particle-particle correlations (p-p and α-α) vs relative momentum (P/sub rel/) are reported (θ/sub lab/≅19.5°) for the reaction 140 MeV /sup 16/O+/sup 27/Al. A plot of the Galilean invariant cross section indicates that evaporative emission dominates the gross proton production even at this forward angle. The observed anticorrelation between two protons for small values of P/sub rel/ is analyzed to give an evaporation lifetime in the range of 1—5 x 10/sup -21/ s. The α-α correlation is completely different; it seems to arise from preformed ^{8}Be.

6515 Nuclear Properties And Reactions, A=39-58, Experimental

12261 **(FRCEA-TH—78) Investigation of incomplete linear momentum transfer in heavy ion reactions at intermediate energies.** Leray, S. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Service de Physique Nucleaire a Moyenne Energie; Paris-11 Univ., 91 - Orsay (France)). Jul 1986. 176p. (In French). NTIS (US Sales Only), PC A09/MF A01. Order Number DE88756246/JAW.

At intermediate energies, heavy ion central collisions lead to the incomplete fusion of the incident nuclei while part of the initial linear momentum is carried away by fast light particles. Experiments were performed with 30 MeV per nucleon neon and 20, 35 and 44 MeV per nucleon argon projectiles bombarding heavy targets. Results obtained with 30 MeV per nucleon neon and 20 MeV per nucleon argon beams are in good agreement with an empirical law established with lighter projectiles. On the contrary, 35 and 44 MeV per nucleon argon projectiles do not follow the same law and fission fragments progressively disappear. A simple model explains the evolution of the amount of transferred linear momentum versus incident energy. The disappearance of the fusion products of the composite system observed with argon projectiles beyond 35 MeV per nucleon is explained by a limitation of the excitation energy per nucleon which can be deposited in a nucleus. The limit is evaluated from nucleon binding energy in nuclei and probability to emit clusters and is in good agreement with experimental data. Because of the coupling between intrinsic motion of nucleons and relative motion of nuclei, some nucleons have a kinetic energy high enough to be emitted: a theoretical model is proposed which rather well fits the data concerning fast nucleons but cannot explain the measured amounts of transferred linear momentum. This is attributed to the existence of other mechanisms.

12262 **(GSI—88-21) Energy dependence of the correlation between projectile fragments and light particles.** Kuehmichel, A. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.); Frankfurt Univ. (Germany, F.R.). Inst. fuer Kernphysik). Sep 1988. 90p. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88756353/JAW.

For the study of the energy dependence of the light-particle emission in peripheral collisions at intermediate incident energies an experiment at the CERN-SC with a /sup 12/C beam with three different incident energies (E/A=30, 48, 84 MeV) and two different targets (/sup 197/Au and /sup 58/Ni) was performed. The azimuthal correlation between the plane spanned by the detected projectile fragment and the beam axis and the emission direction of a coincidently to this emitted light particle (p, d, t, α) was determined. At the highest incident energy studied the already known effect of the transverse-momentum transfer to a highly-excited subsystem consisting of target and projectile nucleons could be detected. At the lower incident energies studied at small relative angles between the projectile fragment and the light particle a contribution growing with decreasing energy of the projectile breakup is detected. Beside this contributions of the effect detected at E/A=84 MeV are found which occurs however here not in the same

dominance. It could be shown that shadowing effects can contribute to the measurement results at the lower incident energies. A final explanation whether these or other effects - which are for instance produced by deep inelastic mechanisms like orbiting - contribute to the emission of light particles was not performed on the framework of this thesis.

6516 Nuclear Properties And Reactions, A=59-89, Experimental

12263 **(INP—1293/PL) Alpha particle scattering from Ni-isotopes at E/sub α/ = 172.5 MeV.** Albinski, J.; Budzanowski, A.; Dabrowski, H. and others. (Institute of Nuclear Physics, Krakow (Poland)). (Institute of Nuclear Physics, Krakow (Poland)). 1985. 49p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705292/JAW.

Differential cross sections have been measured for the elastic and inelastic scattering of 172.5 MeV alpha particles from /sup 58,/ /sup 60,/ /sup 62,/ /sup 64/Ni nuclei. The analysis of the experimental data of elastic scattering in terms of optical potentials indicates on increasing neutron skin thickness in the isotopic sequence from /sup 58/Ni to /sup 64/Ni. Coupled channel analyses based on the anharmonic vibrational model approach determine the values of the dynamic deformation parameters for the most strongly excited states rather precisely and reveal enhanced hexadecapole (0/sup +/->4/sub 1//sup +/) transitions. Using an implicit folding model procedure with a correction for the density-dependence of the effective α - nucleon interaction isoscalar transition rates are extracted and compared to electromagnetic results. 37 refs., 5 figs., 7 tabs.

6517 Nuclear Properties And Reactions, A=90-149, Experimental

12264 **(GSI—88-18) Isomerism and beta decay: Conversion-electron and γ spectroscopy of neutron-deficient nuclei around /sup 100/Sn and /sup 146/Gd.** Barden, R. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.); Mainz Univ. (Germany, F.R.)). Aug 1988. 152p. (In German). NTIS (US Sales Only), PC A08/MF A01. Order Number DE88756351/JAW.

In the present thesis the properties of nuclei in the neighbourhood of the double shell closure /sup 100/Sn (Z=N=50) and /sup 146/Gd (Z=64, N=82) were studied by application of γ and conversion-electron spectroscopy. (orig./HSI).

12265 **(IAE—4621/2) Investigation on the γ-radiation of /sup 148/Sm from the (n,n'γ) and (n-bar/sub res/,γ) reactions.** Govor, L.I.; Demidov, A.M.; Cherepantsev, Yu.K. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1988. 17p. (In Russian). NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705253/JAW.

Γ-spectrum, angular distributions and linear polarization of γ-quanta from /sup 148/Sm(n, n/sup '/γ) reaction and γ-spectrum in /sup 147/Sm(n-bar, γ)/sup 148/Sm reaction were measured. The scheme of levels and γ-transitions for /sup 148/Sm was constructed. Multipole mixtures in γ-transitions were determined. 5 refs.; 3 figs.; 7 tabs.

12266 **(LBL—26149) Superdeformation and some new results with HERA.** Diamond, R.M. (Lawrence Berkeley Lab., CA (USA)). Oct 1988. Contract AC03-76SF00098. 24p. (CONF-8809118—3). NTIS, PC A03/MF A01 - OSTI. Order Number DE89004651/JAW.

From 20. international summer school on nuclear physics; Mikolajki, Poland (2 Sep 1988).

This paper investigates superdeformed bands from a collection of nuclear reaction experiments, for example the Silicon 29{endash}Tin 124 reaction. 26 refs., 18 figs. (LSP)

12267 **(LYCEN-T—8742) Peripheral collisions induced by heavy ions /sup 20/Ne projectile fragmentation at 30 MeV/Nucleı. Backscattering at 0.5 Mev/nuclei. Surface analysis method.** Stern-Jacquin, M. (Lyon-1 Univ., 69 (France); Lyon-1 Univ., 69 - Villeurbanne (France). Inst. de Physique Nucleaire). 1987. 148p. (In French). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88756264/JAW.

The emitted products in the reaction /sup /2/sup 0/ Ne -> /sup /9/sup 3/ Nb at 30 Mev/nucleon have been detected and identified in an angular range limited to 6/sup 0/ - 50/sup 0/ for light particles and to 6/sup 0/ - 25/sup 0/ for projectile - like fragments. The velocity distributions of the reaction products show by the way of inclusive measurements the coexistence of different mechanisms: quasi-elastic transfer and fragmentation. Exclusive measurements allow us to distinguish two components: one is due to the transfer followed by one desexcitation step, another one is due to the inelastic break-up for which evaporation contributes to the relaxation and the angular dispersion of the detected fragments. The techniques developed for the fragment identification have been employed to improve the performances of the baskscattering analysis. The utilization of heavy ions associated to the measurement of the velocity by time of flight gives good selectivity and depth resolution. The advantages of this method are illustrated by some examples of semi-conductor surface analyses.

12268 **Levels in /sup 112/Pd and /sup 102/Mo.** Estep, R.; Sheline, R.K.; Decman, D.J.; Henry, E.A.; Mann, L.G.; Meyer, R.A.; Stoeffl, W.; Ussery, L.E.; Kantele, J. (Florida State University, Tallahassee, Florida 32306). *Physical Review [Section] C: Nuclear Physics;* **39**: No. 1, 76-81(Jan 1989).

Particle-gamma-ray coincidence spectra from the /sup 110/Pd(t,pγγ)/sup 112/Pd and /sup 100/Mo(t,pγγ)/sup 102/Mo reactions were measured with enriched /sup 110/Pd and /sup 100/Mo targets bombarded by 16-MeV tritons to obtain more complete level structures for /sup 112/Pd and /sup 102/Mo. The resultant ground state band of /sup 112/Pd and that of /sup 120/Xe are used in the interpretation of coexistence in /sup 116/Sn. The possible observation of backbending in /sup 102/Mo is used to investigate the A dependence of backbending over a wider mass region.

12269 **Nuclear charge radii of the Te isotopes from muonic atoms.** Shera, E.B.; Hoehn, M.V.; Fricke, G.; Mallot, G. (Los Alamos National Laboratory, University of California, Los Alamos, New Mexico 87545). *Physical Review [Section] C: Nuclear Physics;* **39**: No. 1, 195-208(Jan 1989).

The muonic atom energies of the 2p-1s and the 3d-2p transitions were measured with a statistical accuracy of better than +- 70 and +- 40 eV, respectively, for /sup 123,124,125,126,128,130/Te. The values for the Barrett equivalent nuclear radii R/sub k// sub ,//sub α/ and for the root-mean-square radii and their differences were calculated first from muonic data alone and second with the addition of published optical data. The latter data provided the radii of /sup 120/Te and /sup 122/Te isotopes, which were not measured by muonic x rays. A combined analysis of the muonic atom and optical isotope shift data yielded high-precision values of the differences in radii ΔR/sub k//sub ,//sub α/ (error < +- 0.5 am) and Δ<r²>/sup 1/2/ (error < +- 0.9 am) between the neighboring isotopes. The optical constants for the Te line λ = 4049 A were determined (including contributions of higher radial moments) to be F = (509 +- 120) mK/fm² and M = -(104 +- 63) x 10³ mK. Systematic behavior of the radius differences in neighboring isotopes and isotones of Ba, Xe, Te, and Sn, together with odd-even staggering of the Te isotopes, are discussed in this paper. The ΔN = 2 Te isotope shifts between even-A nuclei decrease nearly linearly with increasing N, which can be explained by a successive decreasing deformation in accordance with the observed systematics.

12270 **Decay of /sup 149/Er/sup g/$^+$/sup m/ by positron and delayed proton emission and by electron capture.** Firestone, R.B.; Nitschke, J.M.; Wilmarth, P.A.; Vierinen, K.; Gilat, J.; Toth, K.S.; Akovali, Y.A. (Lawrence Berkeley Laboratory, University of California, Berkeley, California 94720). *Physical Review* [*Section*] *C: Nuclear Physics;* **39**: No. 1, 219-232(Jan 1989).

In this study the decay of /sup 149/Er/sup g/$^+$/sup m/ by positron emission, electron capture, and β-delayed proton emission was investigated. Gamma rays associated with /sup 149/Er/sup m/ decay were placed in a decay scheme on the basis of $\gamma\gamma$ and xγ coincidences and half-life. We assigned 120 γ rays deexciting 91 levels in /sup 149/Ho to 8.9 +- 0.2 s /sup 149/Er/sup m/ decay. The πs/sub 1/2/ single-particle state in /sup 149/Ho was observed to occur at 49.0 keV above the πh/sub 11/2/ ground state. A (3.5 +- 0.7) % isomeric transition decay branch and a (0.18 +- 0.07) % β-delayed proton decay branch were determined for /sup 149/Er/sup m/ decay. Three additional γ rays were assigned to 4 +- 2 s /sup 149/Er/sup g/ decay and a (7 +- 2) % β-delayed proton decay branch was determined. Measured EC/β^+ ratios to proton emitting states in /sup 149/Ho resulted in a (Q/sub E//sub C/-S/sub p/) = 7.0/sup +5.0//sub -0.4/ MeV for /sup 149/ER^a decay and a S/sub p/ = 1.4/sup +10//sub -0.6/ MeV for Ho. The β-delayed proton spectrum from /sup 149/Er/sup g/ consisted of a highly structured component corresponding to the deexcitation of levels between 4 and 5 MeV in /sup 149/Ho and a structureless component corresponding to decay from higher levels. The β-strength function for /sup 149/Er/sup g/$^+$/sup m/ decay is discussed in terms of single-particle shell-model structure, weak coupling to the /sup 148/Dy core, and decay of πh/sub 11/2/ protons across the shell closure to the νh/sub 9/2/ neutron orbital.

6518 Nuclear Properties And Reactions, A=150-189, Experimental

12271 **(CONF-881054—41) Lifetime measurement of the correlated continuum gamma rays in ^{170}Hf.** Lee, I.Y. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 11p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005105/JAW.

From 4. annual DOE model conference; Oak Ridge, TN, USA (3 Oct 1988).

Continuum gamma rays are generally emitted at the early stages of the gamma decay of a compound nucleus. These gamma rays are from states with higher angular momentum and excitation energy than the discrete gamma rays. Therefore, from the study of continuum gamma rays it is possible to obtain information on nuclear properties in regions unreachable through studies of discrete transitions. In the current measurements we have applied the Doppler-Shift Attenuation Method to the full gamma-gamma correlation matrix, enabling us to determine the lifetime of the ridge in ^{170}Hf over a large range of energy. With our Compton Suppression Spectrometer System, it was possible to carry out these measurements with good energy resolution and a high peak-to-Compton ratio. 2 refs., 2 figs.

12272 **(GANIL-P—88-10) Total cross sections of reactions induced by neutron-rich light nuclei.** Saint-Laurent, M.G.; Anne, R.; Bazin, D.; Guillemaud-Mueller, D.; Jahnke, U.; Jin Gen Ming; Mueller, A.C.; Bruandet, J.F.; Glasser, F.; Kox, S. (Grand Accelerateur National d'Ions Lourds (GANIL), 14 - Caen (France)). (Grand Accelerateur National d'Ions Lourds (GANIL), 14 - Caen (France)). 1988. 19p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756157/JAW.

Total nuclear reaction cross-sections are determined by means of a 4π-γ method. The results cover a wide span of targets for various stable beams. The validity of the method is shown in a combined systematics includings also the results of transmission-type experiments. The data are very well described by the formula developed by Kox et al. The same method is applied to secondary fragment beams produced from a 44 MeV/u /sup 22/Ne beam on a 332 mg/cm/sup 2/ /sup 181/Ta target. Using the LISE spectrometer the fragments /sup 4/He,/sup 6/He, /sup 6/Li,/sup 9/Li, /sup 11/Li, /sup 7/Be,/sup 9/Be, /sup 12/Be, /sup 14/Be, /sup 10/B, /sup 15/B, /sup 17/B, /sup 11/C, /sup 19/C, /sup 13/N, /sup 19/N, /sup 15/O, /sup 21/O, /sup 18/F, /sup 21/F and /sup 20/Ne, /sup 21/Ne are analyzed and transported to interact with a 199.4 mg/cm/sup 2/ Cu target surrounded by a 4π-γ counter. The measured total reaction cross-sections σ/sub R/ are discussed in terms of the reduced strong absorption radius r/sub O/ and compared with other experimental results.

12273 **(JINR-R—6-88-117) Possibility of revealing soft primary γ-transitions in (n,2γ) reaction.** Boneva, S.T.; Vasil'eva, Eh.V.; Popov, Yu.P.; Sukhovoj, A.M.; Khitrov, V.A.; Grigor'ev, E.P. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics; Leningradskij Gosudarstvennyj Univ. (USSR). Nauchno-Issledovatel'skij Fizicheskij Inst.). (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics). 1988. 10p. (In Russian). NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS. Order Number DE88705309/JAW.

Submitted to the 38. conference on nuclear spectroscopy and nuclear structure, Baku, 1988.

The possibility of definition of order following gamma-transitions in some two-quanta cascades is analyzed in the events when decay scheme for compound nucleus completely established for excitation energy E/sup */$\sim$1.5-2 MeV. Seven cascades are revealed for /sup 178/Hf compound-nucleus that probably begin primary transition with E/sub γ/$\sim$1-1.5 MeV energy. The maximal possible value of radiative strength function for such transitions is estimated. 8 refs.; 1 fig.; 1 tab.

12274 **(JINR-R—6-88-118) Intensive two-quantum cascades and new levels in /sup 183/W.** Boneva, S.T.; Vasil'eva, Eh.V.; Popov, Yu.P.; Sukhovoj, A.M.; Khitrov, V.A.; Yazvitskij, Yu.S. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics). 1988. 11p. (In Russian). NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705310/JAW.

Submitted to the organizing committee of the meeting on nuclear spectroscopy and atomic nuclear structure, Baku, 1988.

The transition energies and intensities of 150 two-quantum cascades that populate 5 low-lying levels of /sup 183/W compound nucleus are determined. In a /sup 183/W level scheme 97 cascades are located. The scheme of /sup 183/W γ-decay at E/sub M/$<$2.2 MeV energy is completed. Above 2.2 MeV the excitation energies and decay modes of 15 levels are determined. The comparison of experimental and calculated sum of cascade intensities shows their very fine conformity. 10 refs.; 2 figs.; 3 tabs.

12275 **(Juel-Spez—458) Studies on the decay of high-spin isomers in the W and Os isotopes and developments of programs for the guidance of the experimental logics and the data acquisition.** Kraemer-Flecken, A. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Kernphysik; Bonn Univ. (Germany, F.R.)). Jul 1988. 128p. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88756513/JAW.

This thesis consists of two parts. In the first part the study of high-spin states of the isotopes /sup 180/Os and /sup 178/W by means of the reactions /sup 164/Dy(/sup 22/Ne,6n) at 106 MeV incident energy and /sup 150/Nd(/sup 34/S,4n) at 155 MeV respectively /sup 164/Dy(/sup 18/O,4n) at 83.5 MeV is described. In the second part the development of programs for data acquisition systems on the basic of microprocessors is described. See hints under the relevant topics. (HSI).

12276 **Irregularities at high spin in the odd-odd nucleus / sup 158/Tm.** Riley, M.A.; Akovali, Y.A.; Baktash, C.; Halbert, M.L.; Hensley, D.C.; Johnson, N.R.; Lee, I.Y.; McGowan, F.K.; Virtanen, A.; Courtney, L.H.; and others. (Oak Ridge National Laboratory and Joint Institute for Heavy Ion Research, Oak Ridge, Tennessee 37831). *Physical Review* [*Section*] *C: Nuclear Physics;* **39**: No. 1, 291-294(Jan 1989).

High spin states in the odd-odd nucleus /sub $<$1//sub 69// sup 58/Tm/sub 89/ were populated in the /sup 110/Pd(/sup 51/V,3n) reaction at 220 MeV. It has been possible to construct a level scheme with states up to spin 36/sup (+)/ (tentatively 38$^+$), the

highest spins measured in an odd-odd nucleus to date. The proposed high-spin level scheme for /sup 158/Tm and its interpretation differ considerably from previous work on this nucleus. Irregularities in the γ-ray energy spacings observed at the highest spins are also discussed.

12277 **Evidence for oscillating two-neutron transfer probabilities at large radial separation in heavy-ion reactions.** Wu, C.Y.; Liu, X.T.; Kernan, W.J.; Cline, D.; Czosnyka, T.; Guidry, M.W.; Kavka, A.E.; Kincaid, R.W.; Kotlinski, B.; Sorensen, S.P.; and others. (Department of Physics, University of Tennessee, Knoxville, Tennessee 37996). *Physical Review [Section] C: Nuclear Physics;* **39**: No. 1, 298-301(Jan 1989).

The populations of the ground-state band and the two-quasiparticle bands in /sup 160/Dy were approximately separated for two-neutron pickup reactions using /sup 58/Ni and /sup 116/Sn ions. The two-quasiparticle transfer probability falls expoenentially at large distance, but the ground-band two-neutron transfer exhibits apparent oscillations which are interpreted as the interference between scattering from different spatial orientations of deformed nuclei. These results appear to resolve the heavy-ion two-neutron transfer slope anomaly.

6519 Nuclear Properties And Reactions, A=190-219, Experimental

12278 **(GSI—88-54-Prepr.) Onset of multi-fragment emission in heavy ion collisions.** Trockel, R.; Hildenbrand, K.D.; Lynen, U.; Mueller, W.F.J.; Rabe, H.J.; Sann, H.; Stelzer, H.; Trautmann, W.; Wada, R.; Eckert, E. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.)). (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.); Frankfurt Univ. (Germany, F.R.); Heidelberg Univ. (Germany, F.R.)). Oct 1988. 15p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756356/JAW.

A multi-detector setup with large solid angle coverage has been used to measure the particle and fragment emission associated with the production of intermediate mass fragments in reactions of /sup 12/C, /sup 18/O, /sup 20/Ne, and /sup 40/Ar on /sup nat/Ag and /sup 197/Au at bombarding energies 30 MeV≦E/A≦84 MeV. It is found that the cross sections, the element distributions, and the multiplicities of intermediate mass fragments are strongly correlated with the excitation energy E/sub x/ deposited in the composite system and that multifragment emission sets in at E/sub x/≅300 MeV.

12279 **(LPCC-T—87-03) Linear momentum transfer and energy dissipation in the /sup 16/O + Au reaction at 30 MeV/u.** Hajfani, A.I. (Caen Univ., 14 (France); Caen Univ., 14 (France). Lab. de Physique Corpusculaire). Jul 1987. 55p. (In French). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88756261/JAW.

The linear momentum transfer and the energy dissipation mechanisms in heavy ion collisions are studied for the /sup 16/O (30 MeV/u) + Au system. The experiment was performed at the heavy ion facility SARA in Grenoble. The experimental set up consisted in two large area parallel plate avalanche counters for fission-fragment detection and telescopes for projectile like-fragments and light charged particle identification. Evidence of incomplete linear momentum transfer was extracted from the measurements of the folding angle between fission fragments. Coincidences between projectile-like fragments and fission fragments allow to follow the linear momentum transfer evolution with the impact parameter. These results are well interpreted in the frame of a friction phase space model. This model leads to target transparency for the fastest nucleons and so limits momentum transfer. The second part of this work deals with the energy dissipation accompanying fission of hot nuclei formed in the incomplete fusion process: high relative velocities between fission fragments observed at high excitation energy correspond to increasing mass width distributions of the detected fragments. This effect cannot be explained in the same way that a low energy coulomb fission process, and so raises the question of the origin of these fragments.

6520 Nuclear Properties And Reactions, A=220 And Above, Experimental

12280 **(CENBG—8801) Study of α and triton particles emission in Uranium 235, Uranium 238, Plutonium 239 fast neutron fission.** Ouasti, R. (Bordeaux-1 Univ., 33 - Gradignan (France). Centre d'Etudes Nucleaires; Bordeaux-1 Univ., 33 (France)). Feb 1988. 114p. (In French). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88756243/JAW.

Fast neutrons up to 2.5 MeV have been used to induce light particle accompanied fission in /sup 235/U, /sup 238/U and /sup 239/Pu targets. The energy spectra and relative intensities of /sup 3/H and /sup 4/He have been measured with a ΔE-E telescope. Absolute particle yields were derived from the number of /sup 4/He particle per 1000 binary fissions of /sup 235/U and /sup 239/Pu induced by thermal neutrons measured under the same geometrical conditions. We observe that all the energy distributions are well reproduced by gaussian lineshape, the mean energies of which remain constant while varying the neutron incident energy. (For all nuclei, the /sup 4/He mean energies lie close to 16 MeV and the corresponding energies for /sup 3/H particle at about 8-9 MeV). The production rates of /sup 3/H and /sup 4/He show a decrease of about 30% between thermal energy and En = 2 MeV with a small maximum at En = 1 MeV. Conversely the /sup 3/H and /sup 4/He particle yields obtained in fast neutron fission of /sup 239/U remain constant between En = 1.5 MeV and En = 2.5 MeV. Some possible explanation for these observations are briefly and qualitatively explored.

12281 **Nucleon exchange in the absence of strong driving forces: The reaction /sup 238/U+/sup 48/Ca at E/sub lab/ = 425 MeV.** de Souza, R.T.; Schroeder, W.U.; Huizenga, J.R.; To-tildeke, J.; Datta, S.S.; Wile, J.L. (Department of Chemistry and Nuclear Structure Research Laboratory, University of Rochester, Rochester, New York 14627). *Physical Review [Section] C: Nuclear Physics;* **39**: No. 1, 114-127(Jan 1989).

Mass number, atomic number, energy, and angular distributions have been measured for the projectile-like fragments from the damped reaction /sup 238/U+/sup 48/Ca at E/sub lab/ = 425 MeV. Correlations in the measured two-dimensional probability distribution P(A,Z) are discussed along with the general dissipative features of the damped reaction mechanism. The first and second moments of the observed atomic and mass number distributions are compared with those of other asymmetric reaction systems. Although the /sup 238/U+/sup 48/Ca system is highly asymmetric, its potential energy surface in the vicinity of the injection point has a nearly zero gradient resulting in a negligible drift in the proton number. The proton drifts observed in reactions of /sup 238/U with five different projectiles vary systematically with the potential gradient. The mass and charge data are compared with quantitative predictions by a dynamical reaction model based on nucleon exchange. The theoretical model gives a reasonable account of the mass and charge distributions for the /sup 238/U+/sup 48/Ca reaction but fails systematically to predict experimental drifts when the driving forces are large.

6530 Nuclear Theory

REFER ALSO TO CITATION(S) 12198, 12211, 12225, 12247, 12266, 12313

12282 **(BONN-HE—88-10) Neutron-deuteron break-up calculations with W-matrix representation of the two-body input.** Frank, T.M.; Haberzettl, H.; Januschke, T.; Kerwath, U.; Sandhas, W. (Bonn Univ. (Germany, F.R.). Physikalisches Inst.). May 1988. 26p. Also published in Phys. Rev., C (Sep 1988) v. 38(3) p. 1112-1118.

This paper provides a further test of employing the W-matrix representation of the two-body T matrix in three-nucleon calculations. Calculating differential neutron-deuteron break-up cross sections with the Malfliet-Tjon potentials I and III, we find that the single-term separable approximation for the two-body T matrix which follows from the W-matrix approach, when used as

input in the three-nucleon Alt-Grassberger-Sandhas equations, leads to results which agree extremely well with benchmark results provided by Witala, Gloeckle, and Cornelius. The present investigations, thus, corroborate and extend the findings obtained previously for elastic neutron-deuteron scattering. Our theoretical results are also compared with recent experimental data obtained at Erlangen, and it is found that the Malfliet-Tjon potential supports a very good reproduction of the overall features of these data. We conclude that the W-matrix approach provides a remarkably simple and efficient tool for high-quality three-nucleon calculations.

12283 **(CONF-880896—6) Concluding remarks presented at the Symposium on heavy ion reaction dynamics on the tandem energy region.** Betts, R.R. (Argonne National Lab., IL (USA)). 1988. Contract W-31109-ENG-38. 8p. NTIS, PC A02/MF A01 - OSTI. Order Number DE89004272/JAW.

From Symposium on heavy-ion reaction dynamics in tandem energy region; Hitachi, Japan (1 Aug 1988).

This paper discusses the divisions between different heavy ion reaction processes. Fusion, deep inelastic, quasi-elastic and elastic interactions are discussed in terms of coupled channel calculations. 20 refs., 8 figs. (LSP)

12284 **(CONF-881002—4) Dynamics of coupled single particle electron and collective nuclear motion in a laser field.** Hartmann, F.X.; Noid, D.W.; Sharon, Y.Y. (Oak Ridge National Lab., TN (USA); Institute for Defense Analyses, Alexandria, VA (USA); Princeton Univ., NJ (USA)). 1988. Contract AC05-84OR21400. 6p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005121/JAW.

From 35. national vacuum symposium and 4th international laser science conference; Atlanta, GA, USA (2 Oct 1988).

A simple model if coupled electronic and collective nuclear motion is used to study energy transfer processes in the presence of a laser field. The complete classical Hamiltonian of the model includes nuclear, electronic and laser field terms. A semi-classical method to extract spectral information from the generated trajectories is used to calculate transition intensities and frequencies for the coupled quantum mechanical transitions. The nuclear term describes a deformed heavy nucleus with potential well parameters based on the recent work by Sharon and Naumann, it sufficiently treats collective nuclear rotational motion lower in frequency than in the single particle nucleon model. We reported on the dynamics of this model in the presence of a laser field; a problem of interest in laser-driven nuclear excitation. 15 refs., 1 fig.

12285 **(CONF-8805140—10) Comparison of meson-exchange model and a QCD [quantum chromodynamics] prediction of GeV d(γ,p)n reaction.** Lee, T.S.H. (Argonne National Lab., IL (USA)). 1988. Contract W-31109-ENG-38. 7p. NTIS, PC A02/MF A01 - OSTI. Order Number DE89003636/JAW.

From International conference on medium- and high-energy nuclear physics; Taipei, Taiwan (23 May 1988).

We show that a meson-exchange calculation of the d(γ,p) reaction is radically different from the QCD prediction by Brodsky and Hiller. 9 refs., 3 figs.

12286 **(CONF-8809203—1) Report on the Oak Ridge workshop on Monte Carlo codes for relativistic heavy-ion collisions.** Awes, T.C.; Sorensen, S.P. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 11p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89003918/JAW.

From 7. international conference on ultrarelativistic nucleus-nucleus collisions; Lenox, MA, United States (26 Sep 1988).

In order to make detailed predictions for the case of purely hadronic matter, several Monte Carlo codes have been developed to describe relativistic nucleus-nucleus collisions. Although these various models build upon models of hadron-hadron interactions and have been fitted to reproduce hadron-hadron collision data, they have rather different pictures of the underlying hadron collision process and of subsequent particle production. Until now, the different Monte Carlo codes have, in general, been compared to different sets of experimental data, according to which results were readily available to the model builder or which Monte Carlo code was readily available to an experimental group. As a result, it has been difficult to draw firm conclusions about whether the observed deviations between experiments and calculations were due to deficiencies in the particular model, experimental discrepancies, or interesting effects beyond a simple superposition of nucleon-nucleon collisions. For this reason, it was decided that it would be productive to have a structured confrontation between the available experimental data and the many models of high-energy nuclear collisions in a manner in which it could be ensured that the computer codes were run correctly and the experimental acceptances were properly taken into account. With this purpose in mind, a Workshop on Monte Carlo Codes for Relativistic Heavy-Ion Collisions was organized at the Joint Institute for Heavy Ion Research at Oak Ridge National Laboratory from September 12--23, 1988. This paper reviews this workshop. 11 refs., 6 figs.

12287 **(DOE/ER/40409—1) [Theoretical studies in nuclear reactions]: Progress report.** (Case Western Reserve Univ., Cleveland, OH (USA). Dept. of Physics). [1988]. Contract FG02-88ER40409. 4p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005163/JAW.

This paper contains information on the following topics: kaon scattering as a probe of bound nucleons; the three nucleon problem; relativity in nuclear physics; Coulomb interaction in momentum space; correlations in many-body scattering and bound state problems; equivalent mesic Lagrangians; and inclusive interactions. (LSP)

12288 **(DOE/ER/40427—18) Towards a QCD derivation of the nucleus.** Miller, G.A. (Washington Univ., Seattle (USA). Dept. of Physics). 1988. Contract FG06-88ER40427. 7p. (CONF-880560—8). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number TI89005120/JAW.

From Topical conference on nuclear quantum chromodynamics; Argonne, IL, USA (19 May 1988).

At low momentum transfer the QCD strong-coupling constant is large, and the expectations based on the strong coupling expansion (in low orders) may provide a valid guide to the strong interaction physics of nuclei. I employ the strong coupling expansion (SCQCD) and argue that quark exchange effects (without interaction) are absent or suppressed. Furthermore, flux-tube rearrangements seem small, and QCD string breaking effects resemble meson emission from hadrons. Thus SCQCD reproduces the qualitative features of the meson-baryon picture of conventional nuclei. 16 refs., 1 tab.

12289 **(DOE/ER/40427—24-N8) [Medium and high energy nuclear physics]: Conference summary.** Henley, E.M. (Washington Univ., Seattle (USA). Dept. of Physics). 1988. Contract FG06-88ER40427. 6p. (CONF-8805140—9). NTIS, PC A02/MF A01 - OSTI. Order Number DE89004568/JAW.

From International conference on medium- and high-energy nuclear physics; Taipei, Taiwan (23 May 1988).

This paper contains comments on the conference on Medium and High Energy Nuclear Physics. The areas discussed are: hadronic physics; electromagnetic processes; and weak interactions. 1 ref., 1 fig. (LSP)

12290 **(GANIL-P—87-24) Limits to the formation of hot fusion nuclei in nucleus-nucleus collisions.** Peter, J.; Tamain, B. (Grand Accelerateur National d'Ions Lourds (GANIL), 14 - Caen (France); Caen Univ., 14 (France). Lab. de Physique Corpusculaire). (Grand Accelerateur National d'Ions Lourds (GANIL), 14 - Caen (France)). 1987. 34p. (CONF-8710373—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756150/JAW.

From Symposium on heavy-ion collisions; Shimoda, Japan (11 Oct 1987).

The maximum temperature which can be sustained by a nucleus is discussed. Methods used to measure the temperature; values measured in fusion reactors; theoretical investigations on the value of the limiting temperature; and information about dynamical limitations on excitation energy storage in nuclei are reviewed. It is concluded that thermalized fusion nuclei are formed at temperatures up to 5 MeV for heavy systems and 6 MeV for medium mass systems. Thermal energy in central nucleus-nucleus collisions might

not exceed some saturation value due to two effects: a sharing of the deposited energy into compressional and thermal energies; and a dynamical competition between thermal energy deposition and fast pre-equilibrium emission.

12291 **(GANIL-P—88-06) Fluctuations of single-particle density in nuclear collisions.** Ayik, S.; Gregoire, C. (Grand Accelerateur National d'Ions Lourds (GANIL), 14 - Caen (France)). 1988. 11p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756155/JAW.

In order to incorporate fluctuations into the extended TDHF, a new approach is proposed. The evolution of the single-particle density is considered as a "generalized Langevin process" in which the correlated part of the two-body collisions acts as a "random force". In the semi-classical approximation, the correlation function of the random force is calculated. A possible algorithm for the numerical solution is discussed.

12292 **(GSI—87-5) Landau's theory of the Fermi liquid in the framework of quantum hadrodynamics.** Henning, P.A. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.); Technische Hochschule Darmstadt (Germany, F.R.)). Mar 1987. 159p. (In German). NTIS (US Sales Only), PC A08/MF A01. Order Number DE88756350/JAW.

In the present thesis fluctuations of cold quantum hadrodynamical nuclear matter were considered under different aspects. In the center thereby stood the Landau theory of the Fermi liquid applied to interacting systems of nucleons and mesons. The simplest system dealt with contains scalar and vector mesons, both isoscalar. For this system isoscalar Landau parameters were calculated under inclusion of a scalar self-interaction. It was shown that by the applied semiclassical procedure also the renormalization of the contributions from the occupied negative-energy states can be correctly gathered. By means of the Landau parameters calculated in this way in different models both the exact solutions for the zero-sound velocity and its approximative solutions were calculated. The fluiddynamical approximation served for the calculation of the isoscalar eigenvibrations of several model nuclei. (orig./HSI).

12293 **(GSI—88-40-Prepr.) Shell effects in the properties of the heaviest nuclei.** Patyk, Z.; Sobiczewski, A.; Armbruster, P.; Schmidt, K.H. (Institute for Nuclear Studies, Warsaw (Poland)). (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.)). Jul 1988. 32p. Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.).

Shell effects are extracted in the following experimental quantities: Mass, alpha-decay energy and half-life, spontaneous-fission barrier and lifetime. The heaviest even-even nuclei known experimentally, with Z=92-108 are considered. This extraction is based on the Yukawa-plus-exponential model, used for the description of the macroscopic part of nuclear mass. The effects are found to be large: e.g. they increase the spontaneous-fission half-life of some nuclei by about 15 orders of magnitude. The sensitivity of these effects to changing the macroscopic model is discussed.

12294 **(GSI—88-41-Prepr.) Two fission modes of the heavy fermium isotopes.** Cwiok, S.; Rozmej, P.; Sobiczewski, A.; Patyk, Z. (Politechnika Warszawska (Poland). Inst. Fizyki; Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.); Institute for Nuclear Studies, Warsaw (Poland)). (Politechnika Warszawska (Poland). Inst. Fizyki; Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.)). Jul 1988. 22p. Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.).

The collective potential energy of even-even heavy isotopes of fermium is studied. The energy is calculated using the macroscopic-microscopic part of the energy and the Strutinski shell correction, based on the Woods-Saxon single-particle potential, is taken as the microscopic part. The energy is analyzed in the five-dimensional deformation space, described by the usual deformation parameters: β_{λ} (λ=2, 3, 4, 5, 6). The results explain in a natural way the simultaneous appearance of both fission modes (with a low and high total kinetic energy of the fragments), observed recently for /sup 258/Fm. The important role of the reflection-asymmetric deformations of the nucleus in this explanation is stressed.

12295 **(INP—1267/PL) Optical programme with the compound nucleus contribution.** Jakiel, J.; Makowska-Rzeszutko, M. (Institute of Nuclear Physics, Krakow (Poland)). 1985. 16p. (In Polish). NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705277/JAW.

In FORTRAN for CDC CYBER 72 and ODRA 1300 computers.

The Fortran programme OMCMPDABS serves for optimization of optical model parameters at cross sections calculation and (or) polarization taking into account the compound nucleus contribution assuming that the spin of incident particle is 1. 11 refs. (A.S.).

12296 **(INP—1276/PL) Statistics and dynamics of strongly collective nuclear processes.** Blocki, J. (Institute of Nuclear Research, Warsaw (Poland); Institute of Nuclear Physics, Krakow (Poland)). (Institute of Nuclear Physics, Krakow (Poland)). 1985. 15p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705280/JAW.

A short introduction to the published and not yet published papers is presented. Two methods of the dynamical calculations - a classical and a selfconsistent quantum mechanical (TDHF) one are discussed. The most interesting results are presented. All the limitations in the use of both methods are also given. 26 refs.

12297 **(INP—1288/PH) Analysis of angular distributions of charged particles produced by negative pions on nuclei at 300 GeV.** Holynski, R.; Nowak, G.; Wilczynski, H.; Wolter, W.; Wozniak, K. (Institute of Nuclear Physics, Krakow (Poland)). 1985. 20p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705289/JAW.

The angular distribution of particles produced in 2115 Pl/sup -/emulsion interactions at 300 GeV has been analysed. The inclusive distribution of shower particles exhibits a pronounced plateau in the central region which extends for about two units of pseudorapidity. Taking advantage of the relation between the number of slow particles emmited from the struck nucleus and the average number of collisions of the projectile inside the target, the dependence of the pseudorapidity distribution on the effective thickness of the target nucleus was investigated. 12 refs., 4 figs., 3 tabs.

12298 **(JINR-E—2-88-105) On the meson exchange currents contribution in deep inelastic scattering on deuteron.** Kaptar', L.P.; Titov, A.I.; Umnikov, A.Yu.; Reznik, B.L. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics; Dal'nevostochnyj Gosudarstvennyj Univ., Vladivostok (USSR)). (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1988. 6p. NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS. Order Number DE88705298/JAW.

Submitted to the journal Pis'ma Zh. Ehksp. Teor. Fiz. .

The contribution of the one- and two-pion exchange currents to the deep inelastic deuteron structure function F/sub 2//sup D/(x) is considered. It is shown that the mesonic corrections do not restore the energy sum rule violated by the off-mass-shell properties of the bound nucleons. 13 refs.; 3 figs.

12299 **(JINR-R—4-88-116) Microscopic description of low-lying isovector quadrupole states in /sup 56/Fe.** Vdovin, A.I.; Nikolaeva, R.; Stoyanov, Ch. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics; Bylgarska Akademiya na Naukite, Sofia. Inst. za Yadrena Izsledvaniya i Yadrena Energetika). (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1988. 6p. (In Russian). NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS. Order Number DE88705308/JAW.

Submitted to the journal Europhys. Lett. .

Microscopic calculations of energies, structure and transition probabilities of low-lying 2/sup +/ states in /sup 56/Fe have been performed in the frameworks of the quasiparticle phonon nuclear

model. The interaction of the phonon appears to play an important role in determination of the isotopic character of low-lying quadrupole states. 14 refs.; 2 tabs.

12300 (RCNP-P—96, pp 48-53) **Study on basic theory for CDCC method for three-body model of deuteron scattering.** Kawai, Mitsuji. (Kyushu Univ., Fukuoka (Japan). Faculty of Science). 1988. (In Japanese). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780017/JAW. (CONF-8712120—).

From Workshop on few-body systems; Ibaraki, Japan (17 Dec 1987).

Recent studies have revealed that the CDCC method is valid for treating the decomposition process involved in deuteron scattering on the basis of a three-body model. However, theoretical support has not been developed for this method. The present study is aimed at determining whether a solution by the CDCC method can be obtained 'correctly' from a 'realistic' model Hamiltonian for deuteron scattering. Some researchers have recently pointed out that there are some problems with the conventional CDCC calculation procedure in view of the general scattering theory. These problems are associated with asymptotic froms of the wave functions, convergence of calculations, and boundary conditions. Considerations show that the problem with asymptotic forms of the wave function is not a fatal defect, though some compromise is necessary. The problem with the convergence of calculations is not very serious either. Discussions are made of the handling of boundary conditions. Thus, the present study indicates that the CDCC method can be applied satisfactorily to actual deuteron scattering, and that the model wave function for the CDCC method is consistent with the model Hamiltonian. (Nogami, K.).

12301 **Pairing fluctuations in rapidly rotating nuclei.** Shimizu, Y.R.; Garrett, J.D.; Broglia, R.A.; Gallardo, M.; Vigezzi, E. (The Niels Bohr Institute, University of Copenhagen, DK-2100 Copenhagen OX, Denmark). *Reviews of Modern Physics;* **61**: No. 1, 131-168(Jan 1989).

Empirical evidence for the existence of pair fluctuations in rapidly rotating nuclei in connection with the pair gap is reviewed. The quantities considered are single-particle energies (routhians) and alignments. While the cranked shell model in the presence of static pair correlations provides an accurate description of data at rotational frequencies below the critical frequency corresponding to the collapse of the static pair gap, conspicuous discrepancies are found in the region of and above the pairing phase transition. In particular, a group of excitations is observed displaying lower excitation energies and smaller alignments than those predicted by the cranked shell model. Such excitations can be characterized as behaving as if the correlations induced by the presence of a pairing condensate were not totally obliterated after the "phase transition." A theoretical model, based on the renormalization of the single-particle motion mixed by the coupling to pairing vibrations, is quite successful in explaining the overall trend of the data at rotational frequencies larger than the critical frequency. Smaller alignments and excitation energies are correlated with configurations displaying particle coupling schemes which profit most from fluctuations of the pair gap about its zero equilibrium value. While this model reproduces many of the experimental features, it still overpredicts the alignments by 2—3 units of $(\hbar/2\pi)$ in the crossing region. Thus other degrees of freedom (both static and dynamic), e.g., deformations, also must play a role at large rotational frequencies.

12302 **Breakup-fusion analyses of single-nucleon stripping to bound and unbound orbits.** Udagawa, T.; Lee, Y.J.; Tamura, T. (Department of Physics, University of Texas, Austin, Texas 78712). *Physical Review* [*Section*] *C: Nuclear Physics;* **39**: No. 1, 47-55(Jan 1989).

A method is presented that is capable of describing on one footing stripping-type reactions, in which the stripped particles are left in either bound or unbound states. The approach is to use the breakup-fusion description even when the stripped particles are bound. Successful applications are presented of this method to a few realistic cases, in which the spin-orbit potential for the stripped particle is taken into account.

12303 **Coarse graining of microscopic variables in the minimal information approach.** Sneppen, K.; Donangelo, R. (The Niels Bohr Institute, University of Copenhagen, DK-2100 Copenhagen OX, Denmark). *Physical Review* [*Section*] *C: Nuclear Physics;* **39**: No. 1, 263-264(Jan 1989).

We show that the statistical multifragmentation model is equivalent to the minimal information theory with carefuiiy chosen coarse-grained microscopic variables.

12304 **Status of the nuclear shell model.** Brown, B.A.; Wildenthal, B.H. (National Superconducting Cyclotron Laboratory, and Department of Physics and Astronomy, Michigan State University, East Lansing, Michigan 48824). *Annual Review of Nuclear Science;* **38**: No. 1, 29-66(1988).

In this review we concentrate on recent results of shell model calculations and related experimental data obtained for the sd-shell nuclei. Model spaces and effective interactions, Gamow-Teller, magnetic dipole, electric quadrupole, and higher multipole matrix elements, and electron scattering form factors are discussed. (AIP)

12305 **Manifestations of the D-state in light nuclei.** Weller, H.R.; Lehman, D.R. (Department of Physics, Duke University, and Triangle Universities Nuclear Laboratory, Durham, North Carolina 27706). *Annual Review of Nuclear Science;* **38**: No. 1, 563-608(1988).

This article reviews experimental evidence for and theoretical progess toward understanding D-state contributions to the wavefunctions of the light nuclei ^{3}H, ^{3}He, ^{4}He, and ^{6}Li. The most convincing and direct experimental evidence for the presence of a D-state component in ^{3}He and ^{4}He is the observation of finite tensor analyzing powers in the radiative capture reaction studies, although it may be difficult to extract quantitative information from these data. Currently the most quantitative information on the ratio of D-wave to S-wave asymptotic normalization constants, eta, is obtained by analytical continuation of tensor analyzing powers observed in nucleon transfer reactions. On the theoretical side, the calculation of the asymptotic parameters, eta and D_2 (DWBA parameters) for the three-nucleon nuclei is the best it can be: converged three-body calculations based on the latest two-nucleon interactions supplemented in some cases by three-body forces. (AIP)

6540 Radiation And Shielding Physics

REFER ALSO TO CITATION(S) 11036

12306 **(CONF-880887—27) Principles of neutron reflection.** Felcher, G.P. (Argonne National Lab., IL (USA)). Aug 1988. Contract W-31109-ENG-38. 9p. NTIS, PC A03 - OSTI; 3; GPO Dep. Order Number DE89003891/JAW.

From 32. international technical symposium on optical and opto-electronic applied sciences and engineering; San Diego, CA, USA (14 Aug 1988).

Neutron reflection is perhaps the most developed branch of slow neutrons optics, which in itself is a direct consequence of the undulatory nature of the neutron. After reviewing the basic types of interactions (nuclear and magnetic) between neutrons and matter, the formalism is introduced to calculate the reflectivity from a sample composed of stacked flat layers and, inversely, to calculate the stacking from reflectivity measurements. Finally, a brief survey of the applications of neutron reflection is given, both in technology and in fundamental research. 32 refs., 6 figs.

12307 **(CONF-8710275—2-Rev.) Anomalous and resonance small angle scattering: Revision.** Epperson, J.E.; Thiyagarajan, P. (Argonne National Lab., IL (USA)). Nov 1987. Contract W-31109-ENG-38. 47p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89003985/JAW.

From International conference on applications and techniques of small angle scattering; Argonne, IL, USA (26 Oct 1987).

Significant changes in the small angle scattered intensity can be induced by making measurements with radiation close to an ab-

sorption edge of an appropriate atomic species contained in the sample. These changes can be related quantitatively to the real and imaginary anomalous dispersion terms for the scattering factor (x-rays) or scattering length (neutrons). The physics inherent in these anomalous dispersion terms is first discussed before considering how they enter the relevant scattering theory. Two major areas of anomalous scattering research have emerged; macromolecules in solution and unmixing of metallic alloys. Research in each area is reviewed, illustrating both the feasibility and potential of these techniques. All the experimental results reported to date have been obtained with x-rays. However, it is pointed out that the formalism is the same for the analogue experiment with neutrons, and a number of suitable isotopes exist which exhibit resonance in an accessible range of energy. Potential applications of resonance small angle neutron scatterings are discussed. 54 refs., 8 figs., 1 tab.

12308 **(CONF-8810118—2) Neutron scattering studies of n(p) at reactor sources.** Mook, H.A. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 15p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005127/JAW.

From Workshop on momentum distributions; Argonne, IL, USA (24 Oct 1988).

What follows is an account of neutron scattering studies on liquid helium done at Oak Ridge over the last 15 or so years. As time progressed, the measurement techniques improved considerably, but more important was our improved understanding of the measurements. In particular, a better understanding was gained of the difficulty of obtaining a condensate fraction from measurements of $S(Q,\omega)$of liquid ^4He. This paper discusses these neutron scattering techniques further. 11 refs., 11 figs.

12309 **(ENEA-RT-COMB—88-7) Add-A-Source technique.** Aparo, M.; Dionisi, M.; Zeppa, P.; Bevacqua, F. (ENEA, Casaccia (Italy). Centro Ricerche Energia; Rome Univ. I (Italy). Dipt. di Energetica). (ENEA, Rome (Italy)). 1988. 18p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705244/JAW.

Counting neutrons emitted by spontaneously fissioning plutonium isotopes is a means for determining Plutonium content in samples. Correlations techniques have been developed for separating such neutrons from a background of nonfission neutrons due to (α, n) reactions. Further procedures are then used to correct the effect of neutron-induced fission. In order to perform such a correction the sample's chemical composition (including the presence of moisture) must be a well known parameter. The present paper reports a theoretical formulation of a new approach (add-a-source technique), which could allow to correct the measurement indipendently by the knowledge of the sample's chemical composition.

12310 (INIS-mf—11332, pp 33) **Neutron physics experiments exploiting the pulsing capability of the Vienna Triga-Mark 2.** Badurek, G. (Atominstitut der Oesterreichischen Universitaeten, Vienna). 1988. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88705189/JAW. (CONF-8809213—).

From IAEA Meeting: 10th European TRIGA users' conference; Vienna, Austria (14 Sep 1988).

12311 **(INIS-mf—11891) Inverse problems in linear transport theory.** Dressler, K. (Kaiserslautern Univ. (Germany, F.R.). Fachbereich Mathematik). Jun 1988. 33p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756505/JAW.

Universitaet Kaiserslautern, Fachbereich Mathematik. Preprint.; no. 140.

Inverse problems for a class of linear kinetic equations are investigated. The aim is to identify the scattering kernel of a transport equation (corresponding to the structure of a background medium) by observing the 'albedo' part of the solution operator for the corresponding direct initial boundary value problem. This means to get information on some integral operator in an integro-differential equation through on overdetermined boundary value problem. We first derive a constructive method for solving direct halfspace problems and prove a new factorization theorem for the solutions. Using this result we investigate stationary inverse problems with respect to well posedness (e.g. reduce them to classical ill-posed problems, such as integral equations of first kind). In the time-dependent case we show that a quite general inverse problem is well posed and solve it constructively.

12312 **(Juel—2202) Monte-Carlo test program with vectorized geometry routines.** Cloth, P.; Filges, D. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorentwicklung). May 1988. 48p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756376/JAW.

The today available supercomputers are SIMD machines (Single Instruction-Multiple Data). This makes a difference compared to nature, and most of the difficulties in vectorization of Monte Carlo programs arise from this fact. The principles of vectorized geometry algorithm, the binary sectioning geometry (BSG) and performance tests are described for radiation transport calculations using parallel processing computers.

12313 **(LA—11390-PR) Radiation transport: Progress report, January 1, 1988--March 31, 1988.** O'Dell, R.D.; Nagy, A. (Los Alamos National Lab., NM (USA)). Dec 1988. Contract W-7405-ENG-36. 37p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89005291/JAW.

Research and development progress in radiation transport for the Los Alamos National Laboratory's Group X-6 for the second quarter of FY 88 is reported. Included are unclassified tasks in the areas of Deterministic Radiation Transport, Monte Carlo Radiation Transport, and Cross Sections and Physics. 39 refs., 16 figs., 1 tab.

12314 **(PB—89-127294/XAB) Center for Radiation Research (of the National Institute of Standards and Technology) technical activities for 1988.** Kuyatt, C.E. (National Inst. of Standards and Technology (NML), Gaithersburg, MD (USA). Center for Radiation Research). Nov 1988. 262p. (NISTIR—88/3869). NTIS, PC A12/MF A01.

See also PB—84-217470.

The report summarizes research projects, measurement-method development, calibration and testing, and data-evaluation activities that were carried out during Fiscal Year 1988 in the NIST Center for Radiation Research. These activities fall in the areas of atomic and plasma radiation, radiation physics, radiometric physics, radiation sources and instrumentation, ionizing radiation, and nuclear physics.

6550 Medical Physics

REFER ALSO TO CITATION(S) 11678, 11909

12315 (AECL—8360, pp 2-21) **National registry for radiation workers.** Kendall, G.M.; Dennis, J.A. (National Radiological Protection Board, Chilton (UK)). Aug 1985. NTIS (US Sales Only), PC A05/MF A01. Order Number DE86703986/JAW. (CONF-8409371—).

From Meeting on epidemiological studies of some populations exposed to ionizing radiation; Pinawa, Manitoba, Canada (19 Sep 1984).

The National Registry for Radiation Workers (NRRW) was set up by the National Radiological Protection Board in 1976. The analysis of registry data has four aims: (a) To determine whether there is any evidence of differences in the causes of and ages at death of workers exposed to different levels of radiation and, if any differences are found, whether it seems likely that they can be attributed to radiation. (b) To estimate the magnitude of the risk, if any differences are found, that seem likely to be attributable to radiation. (c) To estimate bounds to the possible risk for particular types of malignancy, such as leukemia. (d) To compare the mortality experience of radiation workers with national mortality data and also with that of other industrial groups for whom data exist. If current estimates of the risks of ionizing radiation are correct, very few deaths will be induced in the study population and it will be impossible to detect them statistically. The NRRW currently includes records for over 60,000 individuals. 6 refs.

12316 (AECL—8360, pp 22-23) **UKEA mortality study.** Stott, A.N.B. (UKAEA Authority Chief Medical Officer's Unit, Harwell). Aug 1985. NTIS (US Sales Only), PC A05/MF A01. Order Number DE86703986/JAW. (CONF-8409371—).

From Meeting on epidemiological studies of some populations exposed to ionizing radiation; Pinawa, Manitoba, Canada (19 Sep 1984).

In addition to the National Registry for Radiation Workers the United Kingdom Atomic Energy Authority conducts its own survey of the mortality experience of its employees. The survey studies the causes of death of all past and present employees with special reference to the effects of radiation exposure on mortality. The auditing of the collection of data and its subsequent analyses is carried out by the Medical Research Council. The population of the study currently comprises over 50,000 individuals. The results of the analyses should be available by the end of 1984.

12317 (AECL—8360, pp 41-45) **Hanford study. Synopses of topics covered.** Gilbert, E.S. (Battelle Pacific Northwest Labs., Richland, WA (USA)). Aug 1985. NTIS (US Sales Only), PC A05/MF A01. Order Number DE86703986/JAW. (CONF-8409371—).

From Meeting on epidemiological studies of some populations exposed to ionizing radiation; Pinawa, Manitoba, Canada (19 Sep 1984).

This paper summarizes epidemiological studies being carried out from data collected at Hanford. The current mortality analyses include deaths up to January 1, 1979. To date multiple myeloma is the only cause of death exhibiting a statistically significant association with radiation exposure. The computer program used to analyze the data has been documented and is now available for use by others with occupational exposure data. Construction workers has been added to the database which formerly only contained operations workers. 7 refs.

12318 (AECL—8360, pp 47-52) **Ontario Hydro mortality surveillance programme.** Anderson, T.W. (British Columbia Univ., Vancouver (Canada). Faculty of Medicine). Aug 1985. NTIS (US Sales Only), PC A05/MF A01. Order Number DE86703986/JAW. (CONF-8409371—).

From Meeting on epidemiological studies of some populations exposed to ionizing radiation; Pinawa, Manitoba, Canada (19 Sep 1984).

The Ontario Hydro mortality surveillance programme was the first such study established in any group of radiation workers. Copies of annual reports are available to senior officials of both management and union and to members of the general public. Apart from an elevated Standardized Mortality Ratio in the 15.0 - 19.9 cSv range, there is no suggestion of any rising cancer death rate with increased lifetime radiation dose. It should be noted that employees who had left before pensionable age were not included in the study. Results of the study are presented in tabular form.

12319 (AECL—8360, pp 53) **Breast cancer mortality following fluoroscopy in a cohort of Canadian tuberculosis patients.** Howe, G.R. (6285500CA). Aug 1985. NTIS (US Sales Only), PC A05/MF A01. Order Number DE86703986/JAW. (CONF-8409371—).

From Meeting on epidemiological studies of some populations exposed to ionizing radiation; Pinawa, Manitoba, Canada (19 Sep 1984).

A highly significant excess of breast-cancer mortality has been shown among women fluoroscoped during treatment for tuberculosis by artificial pneumothorax in the Canadian Study of Cancer following Multiple Fluoroscopies. The effect is strongly dependent on age at first exposure, showing decreased risk with increasing age. Data from Nova Scotia show a much greater response per unit dose.

12320 (AECL—8360, pp 55-57) **Atomic Energy of Canada Limited (AECL) employee health study. A status report.** Weeks, J.L. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). Aug 1985. NTIS (US Sales Only), PC A05/MF A01. Order Number DE86703986/JAW. (CONF-8409371—).

From Meeting on epidemiological studies of some populations exposed to ionizing radiation; Pinawa, Manitoba, Canada (19 Sep 1984).

The Atomic Energy Health Study formally began in April 1980. The purpose of the study is to determine the causes of death among a population of radiation workers and to compare this information with data available for the causes of death in the general population. The study population and the implementation are briefly discussed. The aim of the study is to determine the real occupational risk of being a radiation worker. 3 refs.

12321 (AECL—8360, pp 58-59) **Atomic Energy of Canada Limited (AECL) employee health study. Follow-up of long-term Chalk River employees.** Myers, D.K.; Werner, M.M. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). Aug 1985. NTIS (US Sales Only), PC A05/MF A01. Order Number DE86703986/JAW. (CONF-8409371—).

From Meeting on epidemiological studies of some populations exposed to ionizing radiation; Pinawa, Manitoba, Canada (19 Sep 1984).

A preliminary examination of records relating to past Chalk River employees provides some reassurance that large numbers of cancer deaths that might be related to occupational radiation exposure do not exist in the groups of employees studied to the end of 1982. The lack of reliable information on deaths of ex-employees who left AECL for other employment prevented the inclusion of this group in this preliminary study. This information will presumably be obtained during the course of the more comprehensive Atomic Energy of Canada Ltd. employee health study. 6 refs.

12322 (AECL—8360, pp 61-66) **Cancer and workers' compensation at Chalk River nuclear laboratories.** Evans, D.W.S. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). Aug 1985. V05/MF A01. Order Number DE86703986/JAW. (CONF-8409371—).

From Meeting on epidemiological studies of some populations exposed to ionizing radiation; Pinawa, Manitoba, Canada (19 Sep 1984).

This paper describes the circumstances leading to the notification to the Worker's Compensation Board of Ontario of two cases of cancer, both involving the lymphatic and haematoporetic systems, in employees at Chalk River Nulcear Laboratories. Twenty of these neoplasms are known to have occurred in the CRNL population between 1966 and 1983. The leukemia/lymphoma ratio observed in the twenty neoplasms is similar to that found in populations not occupationally exposed to ionizing radiation. The possible relationship between asbestos exposure and lymphoid neoplasms was discussed. 5 refs.

12323 (AECL—8360, pp 68) **Cohort study of employees of Eldorado Resources Limited.** Howe, G.R.; Abbatt, J.D. (6285500CA). Aug 1985. NTIS (US Sales Only), PC A05/MF A01. Order Number DE86703986/JAW. (CONF-8409371—).

From Meeting on epidemiological studies of some populations exposed to ionizing radiation; Pinawa, Manitoba, Canada (19 Sep 1984).

This study has determined the mortality experience of Eldorado Resources Limited employees between 1950 and 1980. This crown corporation is involved in the mining and processing of uranium products. An initial analysis shows significant excesses of lung cancer deaths at Port Raduim and Beaverlodge mines and a smaller, nonsignificant excess at the Port Hope refinery. The lung-cancer mortality has been analyzed as a function of radon-daughter exposure. This initial analysis is currently being refined to further develop estimates of excess risk.

12324 (AECL—8360, pp 28-39) **U.S. department of energy health and mortality study. The Oakridge studies.** Fry, S.A.; Lushbaugh, C.C.; Shy, C.M.; Cragle, D.L.; Checkoway, H.; Blum, S.; Carpenter, A.V.; Dupree, E.A.; Frome, E.L.; Groer, P.G. Aug 1985. NTIS (US Sales Only), PC A05/MF A01. Order Number DE86703986/JAW. (CONF-8409371—).

From Meeting on epidemiological studies of some populations exposed to ionizing radiation; Pinawa, Manitoba, Canada (19 Sep 1984).

Epidemiological studies to evaluate health and mortality among persons employed at some time since 1942 by the U.S. Department of Energy and its predecessors are being carried out by investigators at the Oak Ridge Associated Universities (ORAU) together with others at Hanford and the Los Alamos National Laboratory. The ORAU is responsible for examining relationships between occupational exposure to ionizing radiations from external and/or internal sources and subsequent health and mortality. The health effects of chemical toxicants, especially uranium and other toxic metals are also being investigated. Approximately one third of the estimated total DOE worker population of 600,000 are included in this study. Some results of the study are tabulated. 13 refs.

12325 **(BARC—1390) Methods and measurements of indoor levels of radon and its daughter products.** Subba Ramu, M.C.; Muraleedharan, T.S.; Ramachandran, T.V.; Shaikh, G.N. (Bhabha Atomic Research Centre, Bombay (India). Pollution Monitoring Sec.). (Bhabha Atomic Research Centre, Bombay (India)). 1988. 42p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704082/JAW.

General population is exposed, some times, to enhanced levels of radon (Rn) and its progeny concontrations in the indoor environment of dwellings, depending on various parameters like type of construction, location and ventilation features of the dwelling as well as on the occupancy factor. The risk involved in the indoor Rn exposure is briefly discussed in this report. Several methods are available for the measurement of Rn and its daughters in dwellings. This report describes in detail some of the suitable and convenient methods for the measurements. Methods for evluating ventilation rate in dwellings is also given. Grab sampling and time integrated measurements are described. The report also gives the results of some preliminary measurements carried out in some rooms and lecture halls of the Bhabha Atomic Research Centre, Bombay. The results are discussed and conclusions drawn with particular reference to a country-wide survey of Rn exposure.

12326 **(CONF-8806280—1) Interspecies extrapolation.** Travis, C.C. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 17p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89002208/JAW.

From NATO advanced research workshop on biologically based methods for cancer risk assessment; Corfu, Greece (11 Jun 1988).

The purpose of this paper is to use physiologically based pharmacokinetic models to demonstrate that if toxic response is proportional to the area under the curve of the concentration of the toxic moiety in the target tissue, then, regardless of the mechanism of action (direct-acting compound, reactive metabolite, or stable metabolite), the appropriate interspecies scaling law for administered dose is the 3/4 power of body weight (modified surface area scaling). The second purpose of this paper is to use physiologically based pharmacokinetic models to demonstrate that if a pharmacokinetic model is used to estimate dose to target tissue, then the appropriate measure of tissue dosimetry for a reactive metabolite is TRM divided by the 3/4 power of body weight. 54 refs., 9 figs.

12327 **(ENEA-RT-COMB—87-16) Post Chernobyl-7. Measurement of radionuclides in the milk at Saluggia and Crescentino (Vercelli).** Giacomelli, R.; Spezzano, P.; Nocente, M.; Bortoluzzi, S.; Dattrino, A.; Missironi, L.; Ornaghi, A.; Silvestri, N.; Porzio, L.; Olivetti, R. (ENEA, Saluggia (Italy). Centro Ricerche Energia; USL 45, Vercelli (Italy)). (ENEA, Rome (Italy)). 1987. 20p. (In Italian). NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705242/JAW.

After a description of the sampling, preparation and measurement method, the values of milk concentration for I/sup 131/, /sup 134/Cs, /sup 136/Cs, /sup 137/Cs, /sup 89/Sr and /sup 90/Sr measured in Saluggia (Vercelli) from May to December, 1986 and in Crescentino (Vercelli from June, 1986 to October, 1987 are here reported.

12328 **(GSF—13/88) Comparative study of some aspects of radiation protection and dosimetry procedures. Pt. 1 and 2. Pt. 1: In the Member States of the European Communities. Pt. 2: In USA and Japan.** Drexler, G.; Goeksu, H.Y.; Johns, T.F. (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H. Muenchen, Neuherberg (Germany, F.R.). Inst. fuer Strahlenschutz). Oct 1987. 229p. NTIS (US Sales Only), PC A11/MF A01. Order Number DE88756349/JAW.

A study has been made of the procedures used in the Member States of the European Communities for dealing with certain practical and administrative aspects of radiation protection of occupationally exposed persons, and especially of the methods and procedures used in personnel dosimetry. It was found that the different states have adopted quite different methods for dealing with some of these problems, the method chosen seeming to depend on the size of the country and the extent and timing of its involvement with nuclear power developments; but although the different countries have adopted different methods of control, as far as we can judge they have all been reasonably effective in achieving adequate control of occupational exposures. Nevertheless, there are still issues that each country could probably learn and perhaps improve its own procedure by making a more careful study of the way in which other countries deal with these problems. Therefore the study was extended to cover the USA and Japan in order to facilitate such comparisons and improvements.

12329 **(INP—1277/D) Estimation of radiation effects of local industrial activity on the population of the Krakow region.** Niewiadomski, T.; Wasiolek, P.; Olszewska, M.; Ryba, E.; Godek, J.; Waligorski, M. (Institute of Nuclear Physics, Krakow (Poland)). 1985. 65p. (In Polish). NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS. Order Number DE88705281/JAW.

The district of Krakow, located in unfavourable climatic conditions is a region with considerable industry emitting large quantities of radioactive ashes. Due to fly-ash emission, radiation exposure to the population arises. We have considered all sources of this radiation exposure and pathways of radionuclide absorption. Indoor gamma ray doses were measured in 210 dwellings around the Krakow district, using TL dosimeters. Concentrations of radon and radon daughters in air were measured at 4 measuring points over 52 one-week cycles using the RWLM-82 chamber. Doses from inhalation and ingestion of radionuclides emitted from 7 local industrial plants were also estimated. The maximum Effective Dose Equivalent Committment from indoor gamma-ray doses amounts to 0.8 mSv a/sup -1/, that from radon daughters was 0.6 - 1.0 mSv a/sup -1/ and that from industrial atmospheric releases 20 μSv a/sup -1/. 20 refs., 13 figs., 11 tabs.

12330 **(JINR—16-88-71) Determination of the absolute value of absorbed dose in tissue-equivalent material in standard source gamma field.** Zel'chinskij, M. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1988. 8p. (In Russian). NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS. Order Number DE88705297/JAW.

The absolute measurements of main dosimetric parameters in the /sup 60/Co field of ROKUS irradiation device are performed in order to create a standard irradiation field for calibration of medical dosemeters. The measurements were made by means of tissue-equivalent ionization chamber with the volume well defined geometrically. Dosimetric parameters were determined basing on the cavity theory with the use of a number of correction factors. The value of the dose rate absorpbed in the tissue-equivalent materual at 75 cm distance from the source center has been obtained to equal (1.2+-0.01) Gy/min by Dec.31, 1987. 3 refs.; 6 figs.; 3 tabs.

12331 **(KFK—4456) Investigation of the mixed beta-photon radiation field in plant areas of the heat steam generator of the Obrigheim nuclear power station.** Burgkhardt, B.; Piesch, E. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Hauptabteilung Sicherheit). Oct 1988. 26p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756390/JAW.

The investigations of the beta-photon radiation field in parts of the plant in the primary circuit were performed by irradiation

experiments in different distances of exhausted disks of the heat steam generator using LiF-TLDs. The depth dose distribution for a detector free of mass is found on the basis of the measurement results by using a standardized extrapolation procedure. The measurement results show that the depth dose distribution is more or less independent of the detector-to-source distance if the absorption in air and the detector is taken into account. Thus low energy beta-photon fields can be analyzed, in general, using the results found in one distance of about 5 cm from the source. For the purpose of radiation protection at working places transmission factors for protective clothes and detectors of different thicknesses were determined. The estimation of the dose equivalents H'(0.07) and H'(10) and the dose equivalents in the lens of the eye and the testes shows that the low energy beta radiation component contributes only to the partial dose equivalent H'(0.07) and will be absorbed by a protective layer of 100 mg.cm/sup -2/.

12332 **(PB—89-120372/XAB) Center for Devices and Radiological Health Publications Index, August 1988.** (Food and Drug Administration, Rockville, MD (USA). Center for Devices and Radiological Health). Aug 1988. 249p. (HHS/PUB/FDA—88-8033). NTIS, PC A11/MF A01.

See also PB—82-160250.

This is the first Publications Index to be published by the Center for Devices and Radiological Health. Previous indexes, titled 'Bureau of Radiological Health Publications Index', were published before the Center was formed in 1982 through the merger of the Bureau of Radiological Health and the Bureau of Medical Devices; the last of these indexes was published in October 1980. The 1988 edition contains records of medical device and radiological health documents authored or published by the Center from 1978 through 1986. It should not be considered all-inclusive since those documents for which bibliographic information was not available have been excluded. The Publications Index is being distributed to Center staff, state radiological health programs, and libraries on the Center's publication mailing list. The Center plans to update and publish the Index every other year to provide a convenient record of published Center documents.

6560 Condensed Matter Physics

REFER ALSO TO CITATION(S) 11345, 11359, 11391, 11400, 11444, 11463, 11586, 12064, 12110, 12307

12333 **(BNL—41322) Experimental evidence for positron trapping at dislocations in Ni_3Al alloys.** Usmar, S.G.; Lynn, K.G. (Brookhaven National Lab., Upton, NY (USA)). 1988. Contract AC02-76CH00016. 3p. (CONF-8808122—13). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004520/JAW.

From 8. international conference on positron annihilation; Gent, Belgium (29 Aug 1988).

Cold worked Ni_3Al alloys were studied using positron lifetime spectroscopy. The isochronal annealing curves of $Ni_{76}Al_{24}$ + 0 and 500 at. ppM B were measured. In pure $Ni_{76}Al_{24}$ three annealing stages were identified while in the boron doped alloy only two were identified. Vacancy annealing (stage III) was found to start at {approximately}250{degree}C in reasonable agreement with previously published data for both alloys. The high temperature annealing stage in boron doped $Ni_{76}Al_{24}$ starts between 750 and 800{degree}C and is complete at 1000{degree}C. This stage was attributed to migration of dislocations to various sinks. In pure $Ni_{76}Al_{24}$ the intermediate and high temperature annealing stages occur at 750 to 800 and 1050{degree}C, respectively. These stages were attributed to the migration of dislocations (750--800{degree}C) and recrystallization ({approximately}1050{degree}C). The nature of the dislocation trap will be discussed.

12334 **(BNL—42163) Single crystal diffraction by synchrotron radiation.** Kvick, A. (Brookhaven National Lab., Upton, NY (USA)). 1988. Contract AC02-76CH00016. 4p. (CONF-8810117—1). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004894/JAW.

From Workshop on applications of synchrotron radiation in chemical research; Argonne, IL, USA (3 Oct 1988).

The tunability and access to short wavelengths in combination with high intensity and the low divergence of the x-ray radiation produced by synchrotron storage rings opens up new and challenging fields for single crystal diffraction. These areas include microcrystal diffraction, studies of time-dependent phenomena, element selective diffraction, studies of materials under extreme conditions, solution of the crystallographic phase problem either by the use of the wavelength dependency of the anomalous scattering or by direct experimental determination of the phases. Single crystal diffraction from proteins and macromolecules using photographic film as a detection medium has already reached considerable maturity, but high-precision data collections using diffractometers at storage rings are still not routine because of the severe requirements for beam stability over extended periods of time. Development work at institutions such as the National Synchrotron Light Source, The Photon Factory, SSRL, CHESS, Hasylab and Daresbury, however, suggest that synchrotron single-crystal diffraction will become an essential part of the research at the synchrotron storage rings in the near future. 9 refs., 2 figs.

12335 **(CEA-CONF—9410) Ionic speciation of Np in frozen solutions.** Litterst, J. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (FR). Dept. de Genie Radioactif; Institut Curie, 75 - Paris (FR); Technische Univ., Muenchen (DE)). (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Genie Radioactif). 1988. 2p. (CONF-8804200—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88756215/JAW.

From 18. actinide meeting; Paris, France (20 Apr 1988).

Light actinides exhibit many oxidation states (II) that are stable in salts and are relatively stable in solution. Np IV to Np VII solutions were prepared and quickly frozen. We report the preliminary results of the /sup /2/sup 37/Np Mossbauer study. These results are discussed and compared to those available for Np compounds in the crystalline state or Np ions in solution. 3 refs.

12336 **(CONF-880378—2) Molecular dynamics studies of the primary state of radiation damage.** Diaz de la Rubia, T.; Averback, R.S.; Robertson, I.M.; Benedek, R. (Illinois Univ., Urbana (USA). Dept. of Materials Science and Engineering; Argonne National Lab., IL (USA)). Dec 1988. Contract W-311C9-ENG-38;AC02-76ER01198. 26p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004196/JAW.

From Workshop on the effects of recoil spectrum and nuclear transmutation on the evolution of the microstructure; Lugano, Switzerland (24 Mar 1988).

This paper summarizes recent progress in the understanding of energetic displacement cascades in metals achieved with the molecular-dynamics (MD) simulation technique. Recoil events with primary-knock-on-atom (PKA) energies up to 5 keV were simulated in Cu and Ni. The initial development of displacement cascades was similar in both metals, with replacement collision sequences providing the most efficient mechanism for the separation of interstitials and vacancies. The thermal-spike behavior in these metals, however, is quite different; Cu cascades are characterized by lower defect production and greater atomic disordering than those in Ni. The thermal spike significantly influences various other properties of cascades, such as total defect production and defect clustering. 32 refs., 7 figs., 2 tabs.

12337 **(CONF-880901—14) Compositional changes during ion bombardment.** Rehn, L.E. (Argonne National Lab., IL (USA)). Sep 1988. Contract W-31109-ENG-38. 23p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89003974/JAW.

From Metallurgical Society fall meeting and American Society for Metals materials week; Chicago, IL, USA (24 Sep 1988).

Ion irradiation initiates several processes that can alter the composition of the target. This presentation provides an overview of our current understanding of these kinetics processes, which include implantation, sputtering, displacement mixing, radiation-enhanced diffusion, and radiation-induced segregation. The latter two effects can alter the target composition to depths that are substantially greater than the projected ion range. 45 refs., 8 figs.

12338 **(CONF-881002—22) Diode laser-initiated, two-color resonance ionization mass spectrometry of lanthanum.** Shaw, R.W.; Young, J.P.; Smith, D.H. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 3p. NTIS, PC A02/MF A01 - OSTI. Order Number DE89003101/JAW.

From 35. national vacuum symposium and 4th international laser science conference; Atlanta, GA, USA (2 Oct 1988).

A GaAlAs semiconductor diode laser at 753.94 nm was utilized to excite the first step of three-photon resonance ionization processes of lanthanum. A practical resonance ionization mass spectrometric (RIMS) instrument based solely on diode laser optical excitation is envisioned. 5 refs., 1 fig.

12339 **(CONF-881155—29) Microstructural characterization of Al_2O_3 following simultaneous triple ion bombardment.** Zinkle, S.J. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 11p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005135/JAW.

From Fall meeting of the Materials Research Society; Boston, MA, USA (28 Nov 1988).

The through-range microstructure of polycrystalline alumina has been examined by cross-section TEM following simultaneous implantation of 2.0 MeV Al^+, 1.44 MeV O^+, and 0.2 to 0.4 MeV He^+ ions at room temperature to a dose of 3.1 keV/atom. The specimen remained crystalline following the irradiation, and four distinct radiation-induced defect features were observed: network dislocations, dislocation loops, small cavities, and oblong clusters that may be aluminum colloids. The microstructure near the implanted ion region was qualitatively similar to that observed in irradiated regions far from the implanted zone. 12 refs., 7 figs.

12340 **(CONF-8802127—3) Processing and quantification of x-ray energy dispersive spectra in the Analytical Electron Microscope.** Zaluzec, N.J. (Argonne National Lab., IL (USA)). Aug 1988. Contract W-31109-ENG-38. 15p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89003654/JAW.

From Workshop on electron-beam induced spectroscopies at very high spatial resolution; Aussois, France (29 Feb 1988).

Spectral processing in x-ray energy dispersive spectroscopy deals with the extraction of characteristic signals from experimental data. In this text, the four basic procedures for this methodology are reviewed and their limitations outlined. Quantification, on the other hand, deals with the interpretation of the information obtained from spectral processing. Here the limitations are for the most part instrumental in nature. The prospects of higher voltage operation does not, in theory, present any new problems and may in fact prove to be more desirable assuming that electron damage effects do not preclude analysis. 28 refs., 6 figs.

12341 **(CONF-8802127—4) Atomic sputtering in the analytical electron microscope.** Bradley, C.R.; Zaluzec, N.J. (Argonne National Lab., IL (USA)). Aug 1988. Contract W-31109-ENG-38. 8p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89003655/JAW.

From Workshop on electron-beam induced spectroscopies at very high spatial resolution; Aussois, France (29 Feb 1988).

The advent of UHV medium voltage electron microscopes has brought the microanalyst to a regime of operating conditions in which electron beam induced damage can now be introduced to metallic specimens of medium to high atomic number. We report upon calculations of electron beam induced atomic sputtering which will have bearing upon the next generation of medium voltage analytical electron microscopes. The cross-section calculations reported herein have been completed for all solid elements of the periodic table for incident electron energies up to 1.5 MeV. All computer codes needed to duplicate these computations are available through the EMMPDL. 12 refs., 2 figs., 1 tab.

12342 **(DOE/ER/13227—5) Pulsed laser photothermal spectroscopy of liquids and solids: Progress report for period December 1, 1987--November 30, 1988.** Eyring, E.M. (Utah Univ., Salt Lake City (USA)). Nov 1988. Contract FG02-84ER13227. 14p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004866/JAW.

Progress of research under this grant is reported since November 30, 1987 (the date of the last Progress Report). Several modifications of photoacoustic and photothermal spectroscopies have been applied to the study of the kinetics and quantum yields of photophysical processes in liquid sample systems. The thermal lens method has been used on a nanosecond time scale and has been found to have advantages over PVDF foil and optical beam deflection photoacoustic techniques. A combined thermal lens and photoacoustic beam deflection experiment has been applied to the study of several dyes that release almost all their excitation energy nonradiatively. Photoacoustic EXAFS experiments have confirmed quantitatively a theory of signal enhancement by volatile liquids. 10 refs., 4 figs.

12343 **(DOE/ER/45222—T1) [Atomic beam studies of the interaction of hydrogen with transition metal surfaces]: Technical progress report for the period August 1, 1985--September 1, 1988.** (Boston Univ., MA (USA). Dept. of Physics). [1988]. Contract FG02-85ER45222. 22p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005256/JAW.

This paper discusses the interactions of helium beams with metal surfaces. Particular topics covered are: improvement in He scattering facilities; spin polarized metastable He beam---a new probe of surface magnetism; and molecular dynamics simulations of the structure and dynamical properties of Cu, Ag and Au surfaces. 6 figs. (LSP)

12344 **(ENEA-RT-TIB—88-20) Diode laser measurements of CF/sub 3/ Cl near 783 cm/sup -1/. Rovibrational analysis of the ν/sub 2/ fundamental.** Baldacchini, G.; Nencini, L.; Bizzarri, A.; Snels, M.; Giorgianni, S.; Gherzetti, S. (ENEA, Frascati (Italy). Centro Ricerche Energia; Venice Univ. (Italy). Dipt. di Chimica Fisica). (ENEA, Rome (Italy)). 1988. 19p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705248/JAW.

The rotational structure of the ν/sub 2/ band of CF/sub 3/ Cl, with natural isotopic abundance, has been investigated using a tunable diode laser spectrometer. The spectra have been obtained for a low temperature sample (about 200 K), to reduce the interfering contributions of hot-band transitions. Due to the very small value of the (ΔA-ΔB) constant for both isotopic species, the K-structure of most P(J) and (R(J) multiplets is generally not resolvable. Only for CF/sub 3//sup 35/Cl, the K-structure could be resolved for P(J) multiplets with J≧55. Molecular constants for the ν/sub 2/ fundamental of both isotopic species have been obtained using least-squares fitting routines in combination with band contour simulations for unresolved K-structure.

12345 (KURRI-TR—299, pp 3-8) **Structural analysis of high-T/sub c/ superconductive oxide by neutron Riedveld method.** Izumi, Fujio. (National Inst. for Researches in Inorganic Materials, Sakura, Ibaraki (Japan)). Jan 1988. (In Japanese). NTIS (US Sales Only), PC A05/MF A01. Order Number DE89780038/JAW. (CONF-8712131—).

From Specialists' seminar on cristal structurization and prephase-transition phenomena by means of neutron diffraction; Kumatori, Japan (11 Dec 1987).

It has been established that the high-T/sub c/ superconductive oxides containing copper are non-stoichiometric compounds of (distorted) K/sub 2/NiF/sub 4/ type crystals and oxygen-deficient triple perovskite type crystals. However, there are still many differences in views among researchers concerning the space groups, deficiency of oxygen atoms, and oxidation state of ions in these high-T/sub c/ superconductive oxides and related compounds. In the present report, major issues on crystal structures are outlined and some comments are presented. A study by convergent electron diffraction has recently shown that the space group of the rhombic La/sub 2/CuO/sub 4-y/ is represented as Cmca. The space groups of the rhombic and tetragonal Ba/sub 2/YCu/sub 3/O/sub 7-y/ crystals have been identified as Pmmm and P/sub 4//mmm, respectively. Unlike K/sub 2/NiF/sub 4/ type superconductors, the y-value of the Ba/sub 2/YCu/sub 3/O/sub 7-y/ type crystals varies widely in the range from 0 to 1. For those with a T/sub c/ around 90 K, the value of y has been suggested by recent studies, including one by the author, to be slightly smaller than 0.1. The dependence

of the Cu/sup +/, Cu/sup 2+/ and Cu/sup 3+/ contents on y in Ba/sub 2/YCu/sub 3/O/sub 7-y/ crystals as determined by iodometry is consistent with the conventional mixed Cu valence model. It is stressed, however, that the positive holes that play the key role in superconduction are not simply localized at Cu or O atoms but should be expressed as [Cu-O]/sup +/. (Nogami, K.).

12346 (KURRI-TR—299, pp 9-15) **Crystal structural study by Rietveld method.** Achiwa, Norio. (Kyushu Univ., Fukuoka (Japan). Faculty of Science). Jan 1988. (In Japanese). NTIS (US Sales Only), PC A05/MF A01. Order Number DE89780038/JAW. (CONF-8712131—).

From Specialists' seminar on cristal structurization and prephase-transition phenomena by means of neutron diffraction; Kumatori, Japan (11 Dec 1987).

For LBa/sub 2/Cu/sub 3/O/sub y/ crystals, X-ray or neutron powder diffraction has been mainly used for crystal structure studies, which have shown that they are rhombic or tetragonal crystals forming the so-called triple perovskite structure. Neutron diffraction is a useful method for investigating the oxygen-deficient positions and the occupancy rate of oxygen in these crystals, which are closely related with their superconduction performance. In the present study, the Rietvelt method is applied to analyzing data obtained by neutron diffraction. La/sub 2/Ba/sub 4/Cu/sub 6/O/sub y/ and La/sub 3/Ba/sub 3/Cu/sub 6/O/sub y/ belong to the same phase regardless of the ratio between La and Ba. In consideration of this fact, neutron powder diffraction is performed to analyze the crystal structures of La/sub 2+x/Ba/sub 4-x/Cu/sub 6/O/sub y/ compounds at room temperature, 77 K and 4.2 K. Results show that in compounds with a larger number of La atoms, La/sup +++/ tends to invade the Ba/sup +++/ site while the number of oxygen atoms at Z = O increases to offset the increase in electric charge. The structure of the La Ba/sub 3/Cu/sub 6/O/sub y/ and La/sub 2.25/Ba/sub 3.75/Cu/sub 6/O/sub y/ compounds respectively is essentially the same at room temperature and 4.2 K. The occupancy rate at the Cu(1) site is smaller by about 10 - 20 percent. In La/sub 2/Ba/sub 4/Cu/sub 6/O/sub y/, the average distances of Ba-O and La-O are 2.88 A and 2.50 A, respectively. Ordinarily, Ba cannot enter the La site. In La/sub 3/Ba/sub 3/Cu/sub 6/O/sub y/, excess oxygen atoms seem to be able to enter the Ba site. (Nogami, K.).

12347 (KURRI-TR—299, pp 16-21) **Determination of space groups of high-T/sub c/ superconductors by convergent beam electron diffraction and microscopy.** Tanaka, Michiyoshi; Tsuda, Kenji. (Tohoku Univ., Sendai (Japan). Faculty of Science). Jan 1988. (In Japanese). NTIS (US Sales Only), PC A05/MF A01. Order Number DE89780038/JAW. (CONF-8712131—).

From Specialists' seminar on cristal structurization and prephase-transition phenomena by means of neutron diffraction; Kumatori, Japan (11 Dec 1987).

The report presents a study on the crystal structure of La/sub 2/CuO/sub 4-δ/ and YBa/sub 2/Cu/sub 3/O/sub 7-y/. The author previously reported that the space group of La/sub 2/CuO/sub 4-δ/ was Pccn, which afterwards was found incorrect. Actually it is Cmca. From observation by conventional electron diffraction, the substances this time are found to have a B-centered structure. Then, investigations are made by convergent beam electron diffraction for direct detection of symmetrical elements. Observations by [001] and [100] incident beams reveal that there are three reflection planes orthogonal to each other, indicating that the point group of this crystal is mmm. A black line (A/sub 2/-GM line) appears in the OkO (k = odd) reflection, which is a direct evidence for the existence of a spiral axis or glide plane. A GM line is also found in the 10 l and 10 l-bar reflections. It is concluded from these results that the space group of these crystals are Bmab. Another investigation is carried out on the crystal structure of YBa/sub 2/Cu/sub 3/O/sub 7-δ/. Material with δ of 0.1 - 0.2 is found to belong to the Pmmm space group. The space group of this type of crystals with δ of about 0.6 is identified as P4/mmm. Those with δ of 0.1 - 0.2 give a streak of diffuse scattering extending from h,k/2,0 in the b* direction in the selected-area diffraction pattern. The diffuse scattering may be associated with regular arrangement of oxygen atoms and vacancies, though direct evidence are not obtained. (Nogami, K.).

12348 (LBL—25002) **Nonlinear optical techniques for surface studies.** Shen, Y.R. (Lawrence Berkeley Lab., CA (USA)). Jul 1988. Contract AC03-76SF00098. 33p. (CONF-880732—2). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89002925/JAW.

From Spectroscopic and diffraction techniques in interfacial electrochemistry; Puerto de la Cruz, Spain (3 Jul 1988).

Second-order nonlinear optical effects have recently been proven to be an extremely versatile analytical tool for surface studies. They are forbidden in media with centrosymmetry and hence, highly surface specific. Being coherent optical techniques, they have high temporal, spatial, and spectral resolution, and are useful for experiments requiring in-situ probing and remote sensing. They also have the advantage of being applicable to any interface accessible by light. In these lectures, we shall give a general review on the development of such techniques. We first present the underlying theory of a second-order optical process at an interface. We then discuss, with examples, the various possible applications of second harmonic and sum-frequency generation for surface studies. 57 refs., 16 figs.

12349 (LBL—26185) **Theory of ground- and excited state-properties of solids, surfaces, and interfaces: Beyond density functional formalsim.** Louie, S.G. (Lawrence Berkeley Lab., CA (USA)). Oct 1988. Contract AC03-76SF00098. 13p. (CONF-8809215—2). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004784/JAW.

From Atomistic modelling in materials - beyond pair potentials; Chicago, IL, USA (27 Sep 1988).

Two recently developed approaches for calculating properties of materials going beyond the density functional formalism are discussed. For excited-state properties, a first-principles quasiparticle theory has been developed. The electron self-energy operator is calculated using the full dielectric matrix and the dressed Green's function. Electron excitation spectra are interpreted as transitions between quasiparticle states of an interacting many-electron system. For ground-state properties, a new method using nonlocal pseudopotentials in conjunction with the variational quantum Monte Carlo approach is introduced. Electron correlations are treated using the exact interaction with a correlated wavefunction of the Jastrow-Slater form. Selected examples from bulk, surface, and interface calculations are presented to illustrate the capabilities of these two approaches. 47 refs., 6 figs., 5 tabs.

12350 (SAND—88-1533C) **Ion implantation and ion beam analysis of lithium niobate.** Arnold, G.W. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 10p. (CONF-881155—26). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004825/JAW.

From Fall meeting of the Materials Research Society; Boston, MA, USA (28 Nov 1988).

Implantations of He and Ti were made into $LiNbO_3$ and the H and Li profiles determined by elastic recoil detection (ERD) techniques. The loss of Li and gain of H depends upon the supply of surface H (surface contaminants or ambient atmosphere). For 50 keV He implants into $LiNbO_3$ through a 200 {Angstrom} Al film, the small Li loss is governed by the interface H. This is also the case for He implants into uncoated $LiNbO_3$ in a beam line with low hydrocarbon surface contamination; similar implants under conditions of greater hydrocarbon deposition result in proportionally larger Li loss and H gain in the implant damage region. The exchange is possible only for those He energies, i.e., 50 keV, where the damage profile intersects the surface. For Ti implants Li is lost with little H gain. For this case the Li loss is believed to result from radiation-enhanced diffusion. Where He implantation is used to establish waveguiding in $LiNbO_3$, the presence or absence of H in the implanted region is crucial with regard to refractive index stability, due to the replacement of H by Li from the bulk. 12 refs., 6 figs.

12351 **(SAND—88-1641C) Laser studies of the SiH radical/surface interaction during deposition of a thin film.** Ho, P.; Buss, R.J.; Breiland, W.G. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 11p. (CONF-881155—15). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89003902/JAW.

From Fall meeting of the Materials Research Society; Boston, MA, USA (28 Nov 1988).

This paper presents a new method for studying the interaction of radicals with the surface of a depositing film using a combination of laser spectroscopy and molecular beam techniques. The reactivity of SiH molecules with the surface of a depositing a-Si:H film is measured to be at least 0.95, with no significant dependence on rotational state. 9 refs., 3 figs.

12352 **(SAND—88-1655C) Hydrogen ion beam smoothening of oxygen roughened Ge(001) surfaces.** Horn, K.M.; Chason, E.; Tsao, J.Y.; Picraux, S.T. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 6p. (CONF-881155—17). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004375/JAW.

From Fall meeting of the Materials Research Society; Boston, MA, USA (28 Nov 1988).

A smooth Ge(001) surface can be severely roughened by chemical etching with oxygen gas and then returned to its original smoothness by exposure to hydrogen. The rate of recovery of the surface depends strongly on temperature, as well as on whether the hydrogen is introduced as a low energy ion beam or simply as a gas. The roughness induced in the surface by etching is "locked-in" after removal of the oxygen gas through pinning of ledges by residual contamination. This pinning prevents the surface from smoothening thermally. The introduction of hydrogen to the surface promotes a chemical reaction which frees the pinned sites and allows thermal smoothening to proceed. 7 refs., 3 figs.

12353 **(SAND—88-1677C) Dislocations and bubbles in BF_2i implanted silicon.** Pike, G.E.; Carr, M.J.; Schubert, W.K.; Hills, C.R.; Nelson, G.C.; McWhorter, P.J. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 6p. (CONF-881155—22). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004582/JAW.

From Fall meeting of the Materials Research Society; Boston, MA, USA (28 Nov 1988).

Defects in crystalline silicon caused by a BF_2^+ ion implantation dose of 3 {times} 10^{15}cm{sup{minus}2} have been studied using plan-view and cross-section TEM and SIMS. Dislocations form at annealing temperatures above 1000{degree}C and are pinned below the Si surface by fluorine bubbles {approximately}10 nm diameter at a density of {approximately}10 ^{11}cm{sup{minus}2}. This microstructure is essentially stable at 1150{degree}C from 4 to 400 minutes. 8 refs., 7 figs.

12354 **(SAND—88-1710C) Electron-beam assisted CVD of silicon homoepitaxial films.** West, J.P.; Fleddermann, C.B. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 8p. (CONF-881155—32). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005238/JAW.

From Fall meeting of the Materials Research Society; Boston, MA, USA (28 Nov 1988).

The use of a wide-area electron beam to aid the deposition of epitaxial silicon films has been studied. The electron beam used in this study is generated using a cold cathode, abnormal-glow discharge which allows a wide variation of electron energy and beam current. Depositions are performed on single crystal silicon substrates which are prepared using standard wet chemical silicon cleaning techniques and an in situ plasma etch using nitrogen trifluoride diluted in hydrogen. The beam diameter is approximately 10 cm and can readily be scaled up to accommodate larger diameters, allowing great potential for large area single wafer deposition. Using electron beams generated in this system, we have demonstrated enhanced growth rates and improved crystalline quality for films grown with electron-beam enhancement. 8 refs., 2 figs., 1 tab.

12355 **(SAND—88-3144C) Atomic-scale modeling of low-energy ion-solid processes.** Dodson, B.W. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 14p. (CONF-881155—18). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004374/JAW.

From Fall meeting of the Materials Research Society; Boston, MA, USA (28 Nov 1988).

Various techniques which have been applied to modeling low-energy ($<<$ 1 keV) ion-solid interactions on an atomistic scale are described. In addition to their individual strengths, all such methods also have a number of drawbacks, both fundamental and practical. The range of validity, and the problems encountered external to this range, will be outlined for the different approaches. Finally, examples of molecular dynamics simulations of low-energy ion-solid interactions will be presented. 23 refs., 5 figs.

12356 **(UCRL—98878) Amorphous and metastable phase formation in systems with positive heats of mixing using high-rate sputter deposition.** Rizzo, H.F.; Echeverria, A.; Massalski, T.B.; Baxi, H. (Lawrence Livermore National Lab., CA (USA)). Nov 1988. Contract W-7405-ENG-48. 6p. (CONF-881155—19). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004043/JAW.

From Fall meeting of the Materials Research Society; Boston, MA, USA (28 Nov 1988).

The triode sputtering technique and a "split-target" arrangement were used to produce metastable crystalline and amorphous phases in the Cu-W, Mo-Cu, Ag-Fe, Ag-Cu, Pu-Ta and Pu-V systems. These systems all exhibit solid immiscibility and have positive heats of mixing and atomic radii that differ by at least 10%. The sputtered coatings, whose thickness varied between 25 and 200 microns, were formed at deposition rates between 35 and 200 {angstrom}/s. They were characterized using x-ray diffraction, TEM, microprobe, microhardness, and DSC techniques. The observed amorphous and metastable solid solution phases are discussed in terms of predicated heats of formation for these phases using Miedema's thermodynamic approximations [1] that include chemical, elastic, and structural contributions. Differences in compositional ranges observed by high rate sputter deposition compared to other vapor deposition techniques (e.g., coevaporation) appeared to arise as a result of processes that occur during deposition or immediately following deposition. 25 refs., 9 figs., 1 tab.

12357 **Determination of the number of scatterers in a finite volume by the statistical analysis of scattered light intensity.** Kazmierczak, M.; Keyes, T.; Ohtsuki, T. (Department of Chemistry, Boston Unviersity, Boston, Massachusetts 02215). *Physical Review [Section] B: Condensed Matter;* **39**: No. 2, 1315-1319(15 Jan 1989).

Light scattering by a random assemblage of independent particles in a finite volume is studied. The statistics of the scattered intensity is found to deviate from a negative exponential law if the number of scatterers exceeds some critical value N/sub c/, determined by the volume, applied wavelength, and scattering angle. A new, nonuniform phase distribution function is presented and utilized in the derivation of the formula specifying the dependence of N/sub c/ on the scattering angle. A practical method leading to the determination of the (large) number of scatterers is proposed and applied to experiments on vapor deposited silica glass.

12358 **Elastic energy of interaction of a point defect with a grain boundary.** Deymier, P.; Janot, L.; Li, J.; Dobrzynski, L. (Department of Materials Science and Engineering, University of Arizona, Tucson, Arizona 85721). *Physical Review [Section] B: Condensed Matter;* **39**: No. 3, 1512-1517(15 Jan 1989).

Analytic expressions for the elastic energy of interaction of a point defect with a planar defect, a plane of dilatation, and half a plane of dilatation in a planar defect have been calculated. The implications with regard to segregation of impurities near high-angle grain boundaries are discussed.

12359 Surface corrugation and surface-polariton binding in the infrared frequency range. Mills, D.L.; Maradudin, A.A. (The Institute for Surface and Interface Science and Department of Physics, University of California, Irvine, California 92717). *Physical Review [Section] B: Condensed Matter;* **39**: No. 3, 1569-1574(15 Jan 1989).

We consider the influence of a small-amplitude grating on the binding of surface polaritons to metal surfaces, with emphasis on the infrared frequency range. The grating can compress the field in the vacuum above the structure very substantially in this regime. Indeed, a grating can bind the surface polariton in the limit of zero skin depth (or infinite conductivity). The results of recent experiments are discussed in light of these results. We also comment on the influence of small-amplitude random roughness on the spatial profile of surface-polariton fields.

12360 Photoemission studies of the metal-nonmetal transition of sodium on solid ammonia. Qiu, S.L.; Lin, C.L.; Jiang, L.Q.; Strongin, M. (Physics Department, Brookhaven National Laboratory, Upton, New York 11973-5000). *Physical Review [Section] B: Condensed Matter;* **39**: No. 3, 1958-1961(15 Jan 1989).

Photoemission experiments were performed to investigate the properties of Na on solid ammonia. At low coverages of Na on solid NH_3 a nonmetallic feature of the Na 2p core level is seen at 33 eV binding energy, which is 2.4 eV deeper than that of the metallic Na 2p core level. This higher-binding-energy features is thought to be due to solvated Na atoms in the NH_3 matrix. At higher coverages it appears that a metallic phase of the Na atoms occurs, along with the appearance of a plasmon loss feature. It was found that the metal-nonmetal transition is associated with these two Na core-level features, coexisting at intermediate Na coverages. This regime is consistent with a phase-separation regime where metallic clusters coexist with a dilute phase which has Na solvated in the NH_3. Another fascinating feature of this Na—solid-NH_3 system is a work-function value as low as 0.9 eV when Na and NH_3 are codeposited at 80 K.

12361 Effective-field-theory model for the fractional quantum Hall effect. Zhang, S.C.; Hansson, T.H.; Kivelson, S. (Institute for Theoretical Physics, University of California, Santa Barbara, California 93106). *Physical Review Letters;* **62**: No. 1, 82-85(2 Jan 1989).

Starting directly from the microscopic Hamiltonian, we derive a field-theory model for the fractional quantum hall effect. By considering an approximate coarse-grained version of the same model, we construct a Landau-Ginzburg theory similar to that of Girvin. The partition function of the model exhibits cusps as a function of density and the Hall conductance is quantized at filling factors $\nu = (2k-1)/sup\ -1/$ with k an arbitrary integer. At these fractions the ground state is incompressible, and the quasiparticles and quasiholes have fractional charge and obey fractional statistics. Finally, we show that the collective density fluctuations are massive.

12362 Evaporative freezing in isolated aggregates. Klots, C.E. (Chemical Physics Section, Health and Safety Research Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee 37831-6125). *Physical Review [Section] A: General Physics;* **39**: No. 1, 339-343(1 Jan 1989).

Cooling by evaporation from an isolated aggregate can be quite rapid. The possibility of bypassing phase transitions and thus of preparing interesting amorphous materials by this vector must then be considered. Evaporation from binary solutions is identified as an especially attractive mechanism for realizing this prospect.

6561 Superconductivity

REFER ALSO TO CITATION(S) 11369, 11374, 11408

12363 (CNIC—00126) Study of structure of high-Tc superconductor Y(YV) Ba/sub 2/Cu/sub 3/O/sub 9-x/ and its resistance sharp drop. Tian Jiemo; Zhang Baoqing; Wang Lingling; Dai Xiaming; Wang Jialong; Pan Guangguo. (Qinghua Univ., Beijing, BJ (China). Inst. of Nuclear Energy Technology). (China Nuclear Information Centre, Beijing, BJ). Dec 1987. 10p. (In Chinese). (TSHUNE—0002). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704104/JAW.

This paper describes the crysal structure of the high-Tc superconductor YBa/sub 2/Cu/sub 3/O/sub 9-x/. X-ray diffraction spectra and transmission electron diffraction patterns show that single phase YBa/sub 2/Cu/sub 3/O/sub 9-x/(orthorhombic cell a = 382.95 pm; b = 388.22 pm; c = 1165.95 pm) can change into the multiphase compound with oxygen content increase. The new high-Tc superconductor Ba/sub 2/(YV)/sub 1/Cu/sub 3/O/sub 9-x/ was investigated. The resistance measurements show that its onset of transition is 118 K, the resistive midpoint of transition is 97 K, and there is zero resistance at 93 K with $\Delta Tc = 2$ K. And, superconductivities of Ba/sub 2/(YV)/sub 1/Cu/sub 3/O/sub 9-x/ system were studied in detail. This paper gives the crystal structure of Ba/sub 2/(YV)/sub 1/Cu/sub 3/O/sub 9-x/ with X-ray diffractions. The resistance sharp drops of YBa/sub 2/Cu/sub 3/O/sub 9-x/ at 190 K and 240 K were found. The changes of transmission electron diffraction patterns indicate the phase change has occurred at about 220 K, and its crystal parameters change obviously.

12364 (CONF-880408—43) Neutron diffraction studies of high-T/sub c/ superconductors. Jorgensen, J.D. (Argonne National Lab., IL (USA)). Mar 1988. Contract W-31109-ENG-38. 6p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004208/JAW.

From Spring meeting of the Materials Research Society; Reno, NV, United States (4 Apr 1988).

Neutron powder diffraction techniques have been used extensively for the study of high-T/sub c/ oxide superconductors because of the need to locate oxygen atoms and accurately determine the oxygen site occupancies, and the difficulty in obtaining single crystals. For example, in the case of $YBa_2Cu_3O/sub\ 7-\delta/$, neutron powder diffraction and Rietveld structural refinement were used to obtain the first complete structural information. Subsequent experiments focussed on determining the relationship of superconducting properties to the number and distribution of oxygen vacancies on the Cu-O sublattice with measurements being done on samples in thermodynamic equilibrium, at high temperature in controlled oxygen atmospheres, and on metastable, oxygen-deficient samples produced by quenching. Neutron powder diffraction has also been used to determine the structures of compounds in which the properties have been modified by substitution on the Y, Ba, or Cu sites. This paper briefly reviews some of the neutron powder diffraction results in these areas. 17 refs.

12365 (CONF-880704—6) The upper critical field of high temperature superconductors. Crabtree, G.W.; Kwok, W.K.; Welp, U.; Burriel, R.; Claus, H.; Vandervoort, K.G.; Liu, J.Z. (Argonne National Lab., IL (USA)). 1988. Contract W-31109-ENG-38. 18p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005828/JAW.

From 6. international conference on crystal-field effects and heavy-fermion physics (ICCHFP-6); Frankfurt am Main, F.R. Germany (18 Jul 1988).

Resistive and magnetic measurements of the superconducting transition in good quality single crystals of $YBa_2Cu_3O/sub\ 7\{minus\}\delta/$ and $La/sub\ 2\{minus\}x/Sr/sub\ x/CuO_4$ and in good polycrystalline samples of $Ba/sub\ 1\{minus\}x/K/sub\ x/BiO_3$ are used to derive the temperature dependence and anisotropy of the upper critical field. Comparison of the results shows several common features, most notably the existence of upward curvature in the temperature dependence of the upper critical field. The definition of T/sub c/ from resistance curves and the origin of the upward curvature in the upper critical field are discussed.

12366 **(CONF-8806281—1) Experimental study of the ultimate limit of flux pinning and critical currents.** Gray, K.E.; Kampwirth, R.T.; Capone D.W. II; Murduck, J.M. (Argonne National Lab., IL (USA)). Aug 1988. Contract W-31109-ENG-38. 13p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89003620/JAW.

From International conference on critical currents in high-temperature superconductors; Snowmass Village, CO, USA (16 Jun 1988).

A flux pinning model, which predicts the maximum critical current density attainable in superconductors, is reviewed and some additional conclusions and considerations, particularly in regard to the model are explored. That such a maximum must exist comes from the realization that flux pinning is strongest in regions of weak superconductivity, but these regions cannot carry a large supercurrent. Since the same regions within the superconductor cannot be used for both pinning and supercurrent conduction, there must be an optimum mix, leading to a maximum J/sub c/. Measurements on films and multilayers of NbN have verified many details of the model including anisotropy effects and a strong reduction in J/sub c/ for defect spacings smaller than the flux core diameter. In an optimized multilayer the pinning force reached {approximately}22% of the theoretical maximum. The implications of these results on the maximum critical current density in the new high temperature superconductors are also discussed. 12 refs., 1 fig.

12367 **(CONF-8810255—1) On the validity of the band model for high T/sub c/ superconductors.** Temmerman, W.M.; Guo, G.Y.; Szotek, Z.; Durham, P.J.; Stocks, G.M. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 11p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005342/JAW.

From International symposium on the electronic structure of High {Tc} superconductors; Rome, Italy (5 Oct 1988).

The discovery of high T/sub c/ superconductivity in cupric oxides has led, amongst other things, to numerous electronic band-structure studies of these compounds. The foundation of these calculations is Density Functional Theory (DFT) and they are implemented with the Local Density Approximation (LDA) or Local Spin Density (LSD) approximation. In this article we will review what we have learned from these calculations regarding the electronic structure of the family of high T/sub c/ materials. To answer this we have to find out how relevant the LSD/LDA is for the electronic properties of cupric oxides. It is well known that the application of LDA DFT for transition metal oxides is fraught with difficulty and controversy. Although the LDA describes the variation of the equilibrium volume through the 3d transition metal oxides, including the volume expansion associated with Mott insulators, the theory fails to describe FeO and CoO as antiferromagnetic insulators, and in the case of NiO and MnO where the LDA does yield an insulating ground state, the band gap is grossly underestimated. Evidently the high-T/sub c/ materials are systems that are on the verge of undergoing a Mott transition; consequently, it is necessary to be circumspect regarding the applicability of LDA DFT both in the metallic (superconducting) and magnetic insulating states. 23 refs., 12 figs.

12368 (KFKI—1988-15/E, pp 15-16) **Neutron scattering study of the vibrational density of states of high T/sub c/ superconductors.** Rosta, L.; Hutiray, Gy.; Bellissent, R.; Menelle, A.; Mezei, F.; Taylor, A.D.; Osborn, R.; Bowden, Z.A. (Hungarian Academy of Sciences, Budapest. Central Research Inst. for Physics; Laboratoire Leon Brillouin, Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France); Hahn-Meitner-Institut fuer Kernforschung Berlin G.m.b.H. (Germany, F.R.); Rutherford Appleton Lab., Chilton (UK)). Mar 1988. NTIS (US Sales Only), PC A03/MF A01. Order Number DE89780005/JAW.

In Experimental studies on high temperature superconductors.

Neutron scattering measurements were performed on polycrystalline Y-Ba-Cu-O ceramics to explore the relationship between structure, vibrational density of states and superconductivity. The experiment was made on three powder samples of YBa/sub 2/Cu/sub 3/O/sub y/. Neutron diffraction data were usedto determine the structure and oxygen content by Rietveld refinement. The inelastic scattering spectra were obtained on the HET spectrometer at the ISIS neutron source. The vibrational density of states spectra were recorded for each sample at different temperatures. A V/sub 3/Ge A-15-type superconductor was used for comparison. (author) 6 refs.; 2 figs.

12369 **(KFKI—1988-15/E) Experimental studies on high temperature superconductors.** Kroo, N. (ed.). (Hungarian Academy of Sciences, Budapest. Central Research Inst. for Physics). Mar 1988. Vp. NTIS (US Sales Only), PC A03/MF A01. Order Number DE89780005/JAW.

Individual papers are processed separately for the data base. (DLC)

12370 **(SAND—88-2858C) Magnetization, flux creep and transport in Tl-Ca-Ba-Cu-O thin films.** Venturini, E.L.; Kwak, J.F.; Ginley, D.S.; Morosin, B.; Baughman, R.J. (Sandia National Labs., Albuquerque, NM (USA)). 11 Nov 1988. Contract AC04-76DP00789. 23p. (CONF-881127—3). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005236/JAW.

From Conference on the science and technology of thin film superconductors; Colorado Springs, CO, USA (14 Nov 1988).

Static magnetization, flux creep, and electrical transport data are presented for thin films in the high-temperature superconducting Tl-Ca-Ba-Cu-O system. Unoriented polycrystalline 0.7 μm-thick films of both Tl-2223 and Tl-2122 were prepared by sequential e-beam evaporation onto yttria-stabilized cubic zirconia and strontium titanate followed by careful post-deposition anneals. Low-field diamagnetic shielding shows very large demagnetization normal to the film, arising from current flow over macroscopic in-plane distances. Above 50 K there is negligible magnetization hysteresis consistent with easy flux motion. The magnetization exhibits a logarithmic time dependence due to activated flux creep with a small pinning energy of 0.083 eV. The transport properties are very different from those of polycrystalline $YBa_2Cu_3O_{7-\delta}$ (Y-123) films. Tl-2223 films have shown critical current densities up to 240,000 A/cm² at 76 K (110,000 A/cm² for Tl-2122 films) with low sensitivity to in-plane magnetic fields and moderate sensitivity to perpendicular fields. This anisotropic behavior indicates that grain boundary Josephson junctions are not dominating the transport. The strong intergranular links and high critical current densities show the potential of these polycrystalline thin films for applications. 26 refs., 6 figs.

6570 Theoretical And Mathematical Physics

REFER ALSO TO CITATION(S) 11592, 12102, 12217, 12243, 12313

12371 **(DOE/ER/13065—558) The integrability condition for dynamical systems.** Das, A. (Rochester Univ., NY (USA). Dept. of Physics and Astronomy). 3 Oct 1988. Contract AC02-76ER13065. 5p. (UR—1091; CONF-8808145—23). NTIS, PC A02/MF A01 - OSTI. Order Number DE89004124/JAW.

From Meeting of the Division of Particles and Fields of the American Physical Society (APS); Storrs, CT, USA (15 Aug 1988).

We derive a geometric condition as the sufficient condition for the integrability of a dynamical system with two Poisson bracket structures. The geometrical meaning of various properties of such systems are also clarified. 2 refs.

12372 **(INP—1269/PL) Position-dependent friction in quantum mechanics.** Srokowski, T. (Institute of Nuclear Physics, Krakow (Poland)). 1985. 17p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705278/JAW.

The quantum description of motion of a particle subjected to position-dependent frictional forces is presented. The two cases are taken into account: a motion without external forces and in the harmonic oscillator field. As an example, a frictional barrier penetration is considered. 16 refs.

12373 **(INP—1284/PL) On summation of perturbation expansions.** Horzela, A. (Institute of Nuclear Physics, Krakow (Poland)). Apr 1985. 17p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705286/JAW.

The problem of the restoration of physical quantities defined by divergent perturbation expansions is analysed. The Pad'e and Borel summability is proved for alternating perturbation expansions with factorially growing coefficients. The proof is based on the methods of the classical moments theory. 17 refs.

12374 **(INP—1285/PH) Bell's inequalities and physical reality.** Chylinski, Z. (Institute of Nuclear Physics, Krakow (Poland)). 1985. 23p. (In Polish). NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705287/JAW.

Bell's theory proves the nonlocal character of quantum mechanics alien to the theory of relativity, which shows how essential were the objections of Einstein against quantum mechanics. Since the experiment on Bell's inequalities favours quantum mechanics, this forces one to revise the notion of physical reality. According to Heisenberg one should distinguish between the quantum-potential reality of relations and the classical-actual reality of events. The hypothesis of internal space-time put forward in previous papers supplies the geometrical framework of such a philosophy. Consequently, relations between the constituents of isolated systems precede the space-time events, which fact essentially modifies the meaning of quantum nonlocality and the physical reality itself. 19 refs.

12375 **(INP—1295/PL) On the physical meaning of the Galilean space-time coordinates.** Kapuscik, E. (Institute of Nuclear Physics, Krakow (Poland)). Dec 1985. 13p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705294/JAW.

Published in 1986.

An operational definition of the Galilean space-time coordinates is discussed. It is shown that the fifth coordinate has a deep physical meaning. 3 refs.

12376 **(JINR-E—2-88-107) Geodesic vector fields on Minkowski space-time and (3+1)-solitary waves.** Donev, S.G. (Bylgarska Akademiya na Naukite, Sofia. Inst. za Yadrena Izsledvaniya i Yadrena Energetika). (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1988. 5p. NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS. Order Number DE88705299/JAW.

In this brief paper we show that among the geodesic vector fields on Minkowski space-time there are fields of (3+1)-solitary wave type.

12377 **(JINR-R—2-88-114) Interaction of solitons in a system described by the Korteweg-de Vries equation with a self-consistent source.** Mel'nikov, V.K. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1988. 20p. (In Russian). NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88705306/JAW.

Submitted to the journal Inverse Probl. .

The system described by the Korteweg-de Vries equation with the source satisfying the stationary Schroedinger equation is considered. Soliton solutions describing waves coming from infinity and then captured in the conditionally periodic oscillatory regime are found in this system. Solutions are also found that describe the decay and fusion of waves. The obtained results are relevant to some problems of hydrodynamics, plasma physics, solid state physics, etc. 4 refs.

12378 **(SAND—88-2788) VISAR88: A new data reduction program for VISARs.** Barker, L.M. (Sandia National Labs., Albuquerque, NM (USA)). Nov 1988. Contract AC04-76DP00789. 37p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005481/JAW.

A modernized program for reducing the data gathered in VISAR experiments has been written. The program translates the measured light intensity vs. time records into velocity vs. time. The theory and application of the program are described, and a listing is provided. 9 refs.

12379 **(SLAC-PUB—4729) On the computer simulation of the EPR-Bohm experiment.** McGoveran, D.O.; Noyes, H.P.; Manthey, M.J. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). Dec 1988. Contract AC03-76SF00515. 4p. (CONF-8810257—1). NTIS, PC A02/MF A01 - OSTI. Order Number DE89005013/JAW.

From Bell's theorem, quantum theory and conceptions of the universe; Fairfax, VA, USA (21 Oct 1988).

We argue that supraluminal correlation without supraluminal signaling is a necessary consequence of any finite and discrete model for physics. Every day, the commercial and military practice of using encrypted communication based on correlated, pseudo-random signals illustrates this possibility. All that is needed are two levels of computational complexity which preclude using a smaller system to detect departures from "randomness" in the larger system. Hence the experimental realizations of the EPR-Bohm experiment leave open the question of whether the world of experience is "random" or pseudo-random. The latter possibility could be demonstrated experimentally if a complexity parameter related to the arm length and switching time in an Aspect-type realization of the EPR-Bohm experiment is sufficiently small compared to the number of reliable total counts which can be obtained in practice. 6 refs.

12380 **(UCRL—53895) An automatic programming system for PDEs based on a relational model of continuous physics problems and a functional model of mathematical analysis.** Balaban, D.J.; Garbarini, J.P. (Lawrence Livermore National Lab., CA (USA)). 10 Oct 1988. Contract W-7405-ENG-48. 65p. NTIS, PC A04/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005698/JAW.

The goal of this research is to improve the productivity of scientists and engineers who develop numerical simulations for physical systems describable by partial differential equations (PDEs). This is to be achieved by creating an automatic programming system. The system will accept as input a natural interactive mathematical specification of the problem, and its output will be an efficient program for computing an accurate numerical approximation to the solution of the problem. Such a system will reduce the tedium and human errors involved in the mathematical manipulations and programming normally involved in a solution. We are building a high-level simulation system for PDE problems based on conservation laws. This system will derive its schemes for many classes of problems. In addition, we are developing symbolic manipulation capabilities for dealing with mathematical analysis at a very sophisticated level. Initially the scope of the system will be limited to PDE problems with smooth solutions. The system will provide significant productivity gains for scientists and engineers working on these problems. Later the system will be extended to include PDE problems with discontinuous solutions. The mathematical techniques required to solve these two classes of problems are quite different. However, the symbolic manipulation capabilities for dealing with mathematical analysis will make the development of such a general system possible. 26 refs., 8 figs.

12381 **(Y—2406) The derivation of a simple, practical equation for the analysis of the entire surface physical adsorption isotherm.** Condon, J.B. (Oak Ridge Y-12 Plant, TN (USA)). Oct 1988. Contract AC05-84OS21400. 23p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89005307/JAW.

An equation is derived from statistical mechanics to describe the entire physical adsorption isotherm. This equation is derived from a few simple assumptions, which include the indistinguishability, the following of the adsorbed molecules, and a statistical mechanical "big box" to model the surface. The equation has been measured to fit the adsorption isotherms for the materials studied. The derived equations has the quality that allows the direct calculation of surface area without any arbitrary proportionality constant. The only other equation of physical adsorption that has this feature is the Brunaur, Emmett, Teller (BET) equation. However, the presently derived equation also applies over the entire range of physical adsorption, in contrast to the BET equation. Also, for the materials

studied, the statistical fit over the BET range was significantly better. Furthermore, the treatment can account for first-layer adsorption on specific sites and still yield the surface-area measurement. In this latter case, it will separate out the first-layer isotherm from the contribution of subsequent layers. With very-high-energy localized sites, the isotherm approaches the Langmuir isotherm at low surface coverages. 5 refs., 3 figs.

12382 **Comparative role of potential structure in classical, semiclassical, and quantum mechanics.** Judson, R.S.; Shi, S.; Rabitz, H. (Department of Chemistry, Princeton University, Princeton, New Jersey 08540). *Journal of Chemical Physics;* **90**: No. 4, 2263-2273(15 Feb 1989).

The corresponding effects of features in the potential on classical, semiclassical, and quantum mechanics are probed using the technique of functional sensitivity analysis. It is shown that the classical and quantum functional sensitivities are equivalent in the classical (small $(h/2\pi)$) and harmonic limits. Classical and quantum mechanics are known to react in qualitatively similar ways provided that features on the potential are smooth on the length scale of oscillations in the quantum wave function. By using functional sensitivity analysis, we are able to show in detail how the classical and quantum dynamics differ in the way that they sense the potential. Two examples are given, the first of which is the harmonic oscillator. This problem is well understood by other means but is useful to examine because it illustrates the detailed information about the interaction of the potential and the dynamics which can be provided by functional sensitivity analysis, simplifying the analysis of more complex systems. The second example is the collinear $H+H_2$ reaction. In that case there are a number of detailed and striking differences between the ways that classical and quantum mechanics react to features on the potential. For features which are broad compared to oscillations in the wave function, the two react in qualitatively the same way. The sensitivities are oscillatory, however, and there are phasing differences between the classical and quantum sensitivity functions. This means that using classical mechanics plus experimental data in an inversion scheme intended to find the "true" potential will necessarily introduce sizeable errors.

12383 **Elastodynamic scattering by a surface-breaking void.** Roberts, R.A. (Materials and Components Technology Division, Argonne National Laboratory, 9700 South Cass Avenue, Argonne, Illinois 60439). *Journal of the Acoustical Society of America;* **85**: No. 2, 561-566(Feb 1989).

The boundary integral formulation is presented for the two-dimensional problem of elastodynamic scattering by a void that breaks the traction-free surface of an elastic half-space. Procedures for numerical evaluation of the resulting integral equation for the displacement of the void surface are described. Numerical results for scattering by a symmetric triangular groove contained in the surface of an elastic half-space are presented that demonstrate the effect of "opening up" a surface-breaking crack. All possible combinations of mode conversion (e.g., bulk-to-surface, surface-to-bulk, etc.) are examined for groove depth/groove width ratios of 1 and 10, and groove depth/Rayleigh wavelength ratios ranging from 0.0 to 1.5.

12384 **Baker—Campbell—Hausdorff relations for the orthosymplectic group OSP(1/2).** Fatyga, B.W.; Kostelecky-acute-accent, V.A.; Truax, D.R. (Physics Department, Indiana University, Bloomington, Indiana 47405). *Journal of Mathematical Physics (New York);* **30**: No. 2, 291-294(Feb 1989).

Baker—Campbell—Hausdorff relations are presented for the connected supergroup associated with the orthosymplectic algebra osp(1/2).

12385 **Computation of elliptic functions.** Critchfield, C.L. (391 El Conejo, Los Alamos, New Mexico 87544). *Journal of Mathematical Physics (New York);* **30**: No. 2, 295-297(Feb 1989).

The duplication formula for Weierstrass' elliptic function is the basis for a simple algorithm by which one can calculate values of that function. As in the case for sin θ, this method is more efficient when the argument is reduced to a value near the origin by addition or subtraction of a suitable number of full periods of the function. When the invariants g_2 and g_3 are real numbers, $(z;g_2,g_3)$ is periodic on both the real and imaginary axes of z, although these periods are not necessarily the basic ones. Convenient formulas for determining the relevant periods are given. They include an expression for $q(k^2)$ in terms of Gauss' arithmetico-geometrical sequence. The method is applied to Jacobian functions by finding the invariants that represent a given k^2. When this parameter is real the periods are well known and the Jacobian functions are calculated directly without transforming to those for which the parameter lies between zero and unity.

12386 **Theorem on elastic collisions between ideal rigid bodies.** Crawford, F.S. (Physics Department and Lawrence Berkeley Laboratory, University of California, Berkeley, California 94720). *American Journal of Physics;* **57**: No. 2, 121-125(Feb 1989).

In an elastic collision between two rigid bodies of arbitrary shape, the component of relative velocity of the impact points along the impulse direction is exactly reversed. The two relative velocity components perpendicular to the impulse direction are usually changed in a nonsimple manner, as for collisions between smooth ellipsoids, but are sometimes simply not changed at all, as for a collision between smooth spheres, or do not exist, as for a collision between an ideal superball and a flat surface.

12387 **Membranes in string theory, trees, the Weil conjectures, and the Ramanujan numbers.** Grossman, B. (Rockefeller University, New York, New York 10021). *Journal of Mathematical Physics (New York);* **30**: No. 2, 506-511(Feb 1989).

It is suggested that the factorization of the inverse partition function for 26-dimensional bosonic string theory can be interpreted as the existence of an 11-dimensional membrane. The geometry of diffusion on trees is found to be especially useful, with the $p\rightarrow 1$ limit corresponding to ordinary diffusion in the plane. Finally, the interpretation of the cohomological information in the Weil conjectures in terms of supersymmetric quantum mechanics and the arithmetic of the semiclassical limit is outlined.

12388 **Separation of the energy of overall rotation in any N-body system.** Jellinek, J.; Li, D.H. (Chemistry Division, Argonne National Laboratory, Argonne, Illinois 60439). *Physical Review Letters;* **62**: No. 3, 241-244(16 Jan 1989).

A general exact procedure for separation of the energy of the overall rotation from the "internal" (vibrational) energy in any (arbitrarily floppy) N-body system is formulated. It is based on following the detailed dynamics of the system and it retains all the dynamical couplings allowing for the flow of energy between the rotation and vibrations. Still, it leads to a complete instantaneous separation of the energies in that the Coriolis term in the Hamiltonian is zero at all times. The utility of the new scheme is illustrated.

12389 **Breakup of Kol'mogorov-Arnol'd-Moser tori of cubic irrational winding number.** Mao, J.; Helleman, R.H.G. (Department of Physics, University of Houston, Houston, Texas 77204-5504). *Physical Review* [*Section*] *A: General Physics;* **39**: No. 1, 344-346(1 Jan 1989).

For the special case in which the irrational winding number is the root of a cubic equation, we present numerical evidence for the validity of some form of residue criterion [Greene, J. Math. Phys. 20, 1182 (1979)]. This is a criterion for the breakup of Kol'mogorov-Arnol'd-Moser tori in two degrees of freedom. The cubic case is essential for future work on four-dimensional maps. While the residues do approach ∞ (respectively, 0) after (respectively, before) the breaking point, it is numerically very difficult to estimate a critical residue value R/sub cr/ for this cubic case (0.15approx. <R/sub cr/approx. <0.26). We do not find the usual "scaling" (Greene, ibid., and Mackay, Ph.D. thesis, Princeton University, 1982). For one particular cubic irrational, however, we have obtained a different form of scaling: At constant residue ($\simeq$0.25) the parameter values k/sub n/ do accumulate on a critical value, k/sub ∞/, for torus breakup like chemical bondk/sub n/-k/sub n-1/chemical bond $\sim$chemical bondp/sub n//q/sub n/-p/sub n-1//q/sub n-1/chemical bond/sup ξ/ as $n\rightarrow\infty$, with a "new" scaling constant $\xi\simeq$0.72, where p/sub n//q/sub n/ is the nth rational ap-

proximant in the continued-fraction expansion of the cubic irrational. For a quadratic irrational this scaling reduces to the usual power-law scaling ~δ⁻/sup n/.

12390 **Kac--Moody algebra from infinitesimal Riemann--Hilbert transform.** Chau, L.; Ge, M. (Department of Physics, University of California, Davis, California 95616). *Journal of Mathematical Physics (New York);* **30**: No. 1, 166-171(Jan 1989).

A general formulation is given for deriving a Kac--Moody algebra in the spectrum space from the infinitesimal regular Riemann--Hilbert transform. Such a Kac--Moody algebra can be obtained for many nonlinear systems, e.g., the (super) principal chiral model with or without a Wess--Zumino--Witten term, the sine-Gordon, Liouville, and KdV equations; reduced two-dimensional gravity (Belinski--Zakharov gravity), and self-dual supersymmetric Yang--Mills theories.

70 FUSION ENERGY

12391 **(EUR—11114) JET joint undertaking. Annual report 1986.** (Commission of the European Communities, Luxembourg). Jun 1987. 57p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88756119/JAW.

The scientific, technical, and administrative status of the JET tokamak program is summarized. The Euratom and international fusion programs are outlined. Main performance results are: volume average electron density = 0.5 (10/sup 20/m/sup -3/); central electron temperature = 8.0 keV; central ion temperature = 12.5 keV; global energy confinement time = 0.9 sec; and fusion parameter performance parameter (simultaneous temperature, density, and energy confinement time) = 2.0 (10/sup 20/m/sup -3/keV.

7001 Plasma Research

REFER ALSO TO CITATION(S) 11181, 11561, 12141

12392 **(ANL/FPP/TM—230) Proceedings of the Vancouver team workshop at the University of British Columbia, 18 and 19 July 1988.** Turner, L.R. (ed.). (Argonne National Lab., IL (USA)). Oct 1988. Contract W-31109-ENG-38. 181p. (CONF-8807145—Summ.). NTIS, PC A09/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004140/JAW.

From Vancouver Team workshop· Vancouver, Canada (18 Jul 1988).

This report discusses problems being worked on in fusion energy. The title of problems being presented are: asymmetrical conductor with a hole; velocity effects and low level fields in axisymmetric geometries; plates over a coil; hollow sphere solved in shell approximation with eddynet-20; and the cantilevered beam. (LSP)

12393 **(CBPF-NF—033/88) Spin glass D-vector model on the Bethe lattice.** Coutinho, S.G.; Almeida, J.R.L. de. (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro, RJ). 1988. 9p. NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS. Order Number DE88705239/JAW.

The stability of the spin-glass phase of the disordered D-vector model on the Bethe lattice is studied in the zero field limit. It was found that no breaking of replica symmetry occurs and for continuous symmetry spin system (D>1) a low moments spin glass solution near T/sub c/ exist only when the spin dimensionality is less than the branching number of the Bethe lattice. The non-zero field limit is also discussed.

12394 **(CONF-8810231—6) Particle transport analysis of pellet fueled JET plasmas.** Baylor, L.R.; Houlberg, W.A.; Milora, S.L.; Schmidt, G.L. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 6p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005092/JAW.

From IAEA technical committee meeting on pellet injection and toroidal confinement; Gut Ising, F.R. Germany (24 Oct 1988).

An understanding of the mechanism controlling particle transport in tokamaks is of crucial importance in projecting the fueling requirements and performance of such devices. Multiple pellet injection experiments have been carried out on JET to determine heating and confinement characteristics of pellet fueled plasmas. We report in this paper on the analysis of electron particle transport in these multi-pellet fueled JET plasmas under ohmic heating, ICRF heating, and NBI heating conditions in primarily limiter configurations. The study of particle transport in JET plasmas is based on measurements by a 6-channel far-infrared interferometer for density profile evolution and H/sub α/ detectors for edge source magnitude. Fluctuation induced transport is frequently suggested as the mechanism responsible for the anomalous particle and heat fluxes observed in tokamaks. As part of our analysis, we compare the determined electron particle and heat fluxes with fluctuation induced transport calculations using electron and ion drift wave mechanisms as the dominant fluctuation spectrum. The Onsager symmetry found in the neoclassical transport theory of fluctuations can be used to determine a connection between the anomalous electron particle and heat flux. 9 refs., 3 figs.

12395 **(DOE/ER/13889—1) Accurate alpha sticking fractions from improved calculations relevant for muon catalyzed fusion: Progress report, May 1, 1988--April 30, 1989.** Szalewicz, K. (Delaware Univ., Newark (USA). Dept. of Physics and Astronomy). Dec 1988. Contract FG02-88ER13889. 8p. NTIS, PC A02/MF A01 - OSTI. Order Number DE89005227/JAW.

This paper discusses the alpha sticking fractions from improved calculations relevant to muon catalyzed fusion. 12 refs. (LSP)

12396 **(DOE/ER/53212—131) Behavior of the reversed field pinch with nonideal boundary conditions.** Ho, Yung-Lung. (Wisconsin Univ., Madison (USA). Dept. of Physics). Nov 1988. Contract FG02-85ER53212. 73p. NTIS, PC A04/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005497/JAW.

The linear and nonlinear magnetohydrodynamic stability of current-driven modes are studied for a reversed field pinch with nonideal boundary conditions. The plasma is bounded by a thin resistive shell surrounded by a vacuum region out to a radius at which a perfectly conducting wall is situated. The distant wall and the thin shell problems are studied by removing either the resistive shell or the conducting wall. Linearly, growth rates of tearing modes and kink modes are calculated by analytical solutions based on the modified Bessel function model for the equilibrium. The effects of variation of the shell resistivity and wall proximity on the growth rates are investigated. The modes that may be important in different parameter regimes and with different boundary conditions are identified. The nonlinear behaviors are studied with a three-dimensional magnetohydrodynamics code. The fluctuations generally rise with increasing distance between the conducting wall and the plasma. The enhanced fluctuation induced v x b electric field primarily oppose toroidal current; hence, loop voltage must increase to sustain the constant. Quasilinear interaction between modes typically associated with the dynamo action is identified as the most probable nonlinear destabilization mechanism. The helicity and energy balance properties of the simulation results are discussed. The interruption of current density along field lines intersecting the resistive shell is shown to lead to surface helicity leakage. This effect is intimately tied to stability, as fluctuation induced v x b electric field is necessary to transport the helicity to the surface. In this manner, all aspects of helicity balance, i.e., injection, transport, and dissipation, are considered self-consistently. The importance of the helicity and energy dissipation by the mean components of the magnetic field and current density is discussed. 88 refs., 41 figs., 3 tabs.

12397 **(DOE/ET/53088—326) The effect of energetic trapped particles on the "ideal" internal kink mode.** Zhang, Y.Z.; Berk, H.L.; Mahajan, S.M. (Texas Univ., Austin (USA). Inst. for Fusion Studies). Dec 1988. Contract FG05-80ET53088. 18p. (IFSR—326). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005390/JAW.

The internal kink stability of a tokamak in the presence of energetic particles is studied. It is found that there exists a stable

window when a finite population of energetic particles are present, and the relation between the predictions of the fishbone theory of Chen-White-Rosenbluth and the fishbone theory of Coppi-Porcelli is explained. The theory indicates why some experiments, like PDX and TFTR, are likely to see fishbone oscillations in conjunction with sawtooth modes, while other experiments can observe sawtooth suppression in presence of hot particles. 14 refs., 3 figs., 2 tabs.

12398 **(DOE/ET/53088—353) Statistical mechanics of a two-field model of drift wave turbulence.** Gang, F.Y.; Scott, B.D.; Diamond, P.H. (Texas Univ., Austin (USA). Inst. for Fusion Studies). Dec 1988. Contract FG05-80ET53088. 10p. (IFSR—353). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005393/JAW.

The absolute equilibrium statistical mechanics of a two-field model of drift wave turbulence is investigated with emphasis on predicting the direction of spectral transfer, and on exploration of the role of density-potential correlation in constraining the nonlinear transfer process. The results indicate that departure from the adiabatic relation {tilde n}/n_0 = e{tilde {phi}}/T/sub e/ allows transfer of total energy to small scales in fully developed turbulence. This prediction is in distinct contrast to intuition based on the one-field Hasegawa-Mima model. The results are verified by direct numerical simulation of the basic mode coupling equations. 9 refs., 2 figs.

12399 **(DOE/ET/53088—354) Theory of weak ion temperature gradient driven turbulence near the threshold of instability.** Mattor, N.; Diamond, P.H. (Texas Univ., Austin (USA). Inst. for Fusion Studies; California Univ., San Diego, La Jolla (USA). Dept. of Physics). Dec 1988. Contract FG05-80ET53088;FG03-88ER53275. 37p. (IFSR—354). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005392/JAW.

This paper presents a theory of weak ion temperature gradient driven turbulence near the threshold of instability. The model considers kinetic ions and adiabatic electrons in a sheared slab geometry. Linear theory shows that for {eta}/sub th/ < {eta}/sub i/ {approx←lt} {eta}/sub th/ + (1+1/{tau})L/sub n//L/sub s/ (where {eta}/sub th/ = 0.95 is the instability threshold and L/sub n//L/sub s/ << 1) then $\gamma << \omega$ and a weak turbulence theory applies. The nonlinear wave kinetic equation indicates that ion Compton scattering is the dominant nonlinear saturation process. The wave kinetic equation is reduced to a differential equation for the spectrum, from which it is shown that the energy scatters to the linearly stable low k/sub y/ modes. The resulting spectrum of fluctuation levels (peaked about k/sub {perpendicular}/ {rho}/sub i/ ≅ 1) is much lower than that suggested by naive extrapolation from the strong turbulence regime. The resulting ion thermal conductivity is also extremely low, so that strong ion heating can be expected to drive the ion temperature gradient to a level where this weakly turbulent threshold regime is surpassed. 27 refs., 4 figs., 1 tab.

12400 **(DOE/ET/53088—355) Self-consistent radial sheath.** Hazeltine, R.D. (Texas Univ., Austin (USA). Inst. for Fusion Studies). Dec 1988. Contract FG05-80ET53088. 39p. (IFSR—355). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005389/JAW.

The boundary layer arising in the radial vicinity of a tokamak limiter is examined, with special reference to the TEXT tokamak. It is shown that sheath structure depends upon the self-consistent effects of ion guiding-center orbit modification, as well as the radial variation of E {times} B-induced toroidal rotation. Reasonabie agreement with experiment is obtained from an idealized model which, however simplified, preserves such self-consistent effects. It is argued that the radial sheath, which occurs whenever confining magnetic field-lines lie in the plasma boundary surface, is an object of some intrinsic interest. It differs from the more familiar axial sheath because magnetized charges respond very differently to parallel and perpendicular electric fields. 11 refs., 1 fig.

12401 **(DOE/ET/53088—356) Theory of neoclassical resistivity-gradient-driven turbulence.** Kwon, O.J.; Diamond, P.H.; Hahm, T.S. (Texas Univ., Austin (USA). Inst. for Fusion Studies; California Univ., San Diego, La Jolla (USA). Dept. of Physics). Dec 1988. Contract FG05-80ET53088;FG03-88ER53275. 30p. (IFSR—356). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005391/JAW.

It is shown that rippling instabilities can tap the density gradient expansion free energy source through the density dependence of the neoclassical resistivity. Linear analyses show that the region where neoclassical rippling modes are significantly excited extends from the edge of the plasma to the region where ν/sub *e/ ≦ 1. Since these modes are non-dispersive, diamagnetic effects are negligible in comparison to the nonlinear decorrelation rate at saturation. Thus, the relevant regime is the 'strong turbulence' regime. The turbulent radial diffusivities of the temperature and the density are obtained as eigenvalues of the renormalized eigenmode equations at steady state. The density gradient acts to enhance the level of turbulence, compared to that driven by the temperature gradient alone. The saturated turbulent state is characterized by: current decoupling, the breakdown of Boltzmann relation, a radial mode scale of density fluctuations exceeding that of temperature fluctuations, implying that density diffusivity exceeds temperature diffusivity, and that density fluctuation levels exceed temperature fluctuation levels. Magnetic fluctuation levels are negligible. 29 refs., 1 fig.

12402 **(DOE/FTR—9004709) [Workshop on advanced current drive concepts, Kyoto, Japan, December 5--9, 1988]: Foreign trip report.** Porter, G.D. (Lawrence Livermore National Lab., CA (USA)). 21 Dec 1988. Contract W-7405-ENG-48. 11p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89004709/JAW.

Many papers on non-inductive current drive were presented at this workshop. It appeared that the experimental results on lower-hybrid current drive and neutral beam current drive are consistent with existing theories. There is some concern about the importance of effects which are not present in existing experiments, such as momentum transfer effects in lower hybrid systems and Alfven instabilities for neutral beam drive. Promising results in electron-cyclotron current drive continue to come from the WT-3 experiment, and several other facilities are preparing experiments. Radial transport of non-thermal electrons could play an important role in these experiments. Fast wave current drive experiments are beginning on JFT-2M and preparations are in place for such experiments on DIII-D. Theoretical analysis of these experiments continue to indicate that they will be successful only with high electron temperatures. Hence they will require additional heating systems such as ECH. Theoretical analysis indicate that bootstrap currents are significant on JT-60, and may be affecting the current profile in JFT-2M. In the remainder of this report, I will briefly discuss the results which were presented by the participants. Several of the authors had prepared their short summary, and I have included these papers in the list of the papers I collected on this trip. This list is included as the bibliography to this report. 7 refs., 6 tabs.

12403 **(GA-A—19424) A survey of ECH [electron cyclotron heating] microwave technology.** Moeller, C.P. (General Atomics Co., San Diego, CA (USA)). Nov 1988. Contract AC03-84ER51044. 9p. (CONF-881031—56). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005351/JAW.

From 8. topical meeting on technology of fusion energy; Salt Lake City, UT, USA (9 Oct 1988).

A survey is presented of the microwave transmission system and antenna technology that has been developed for electron cyclotron heating (ECH) experiments using gyrotron and FEL sources. The development of these sources make the bulk heating of a fusion reactor a realistic possibility. Utilization of these sources, with their high unit output power and higher order output modes, has required the development of novel transmission and launching systems. Many examples of such systems applied to tokamaks will be given. 38 refs., 8 figs.

12404 **(IAEA-CN—50/A-1-3) Latest JET results and future prospects.** Bickerton, R.J. (JET Joint Undertaking, Abingdon (UK)). 1988. Contract AC05-84OR21400. 34p. (CONF-881015—36). NTIS, PC A03/MF A01 - OSTI. Order Number TI89005091/JAW.

From 12. international conference on plasma physics and controlled nuclear fusion research; Nice, France (12 Oct 1988).

Following technical modification to the machine the plasma current in JET has been increased to 7MA for limiter-bounded plasma and to 5MA for single-null, magnetic separatrix operation. Additional heating power has been raised to 20MW of neutral beam injection and 18MW of ion cyclotron resonance heating. Ion temperatures up to 23 keV, central densities up to 1.8 10^{20}m/sup {minus}3/ and energy confinement times up to 1.2s are achieved in different discharges. The level of carbon and oxygen impurities is a major problem with the ratio between deuterium and electron densities in the range 0.15--0.80 depending on conditions. Several features of α-particle physics have been studied, notably by the RF heating of minority ions to mean energies of order ! MeV. The fast particles slow down and heat the plasma in broad agreement with expectation. Plasma conditions in deuterium plasmas corresponding to an equivalent (D-T) thermonuclear Q ~ 0.1 and total Q ~ 0.25 (including non-thermal reactions) have been reached. Exploiting the full high current, high power capability of the equipment is expected to increase these figures to {approximately}0.3 and 0.6, respectively. Still further increases can be expected when various changes and additions are implemented. These are designed to control profiles of density and current and at the same time reduce the impurity content. Extrapolating the JET confinement data to a reactor-scale plasma shows that there should not be a problem with energy confinement but rather with disruptions and the control of particles and impurities. Experiments on both these aspects are planned including fueling by high-speed pellets and feedback stabilization of the instabilities which precede disruptions. 20 refs., 18 figs.

12405 **(IAEA-CN—50/A-3-2) The JET H-mode at high current and power levels.** Keilhacker, M. (International Atomic Energy Agency, Vienna (Austria)). 1988. Contract AC05-84OR21400. 31p. (CONF-881015—35). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005063/JAW.

From 12. international conference on plasma physics and controlled nuclear fusion research; Nice, France (12 Oct 1988).

As is well-known, the H-mode observed in plasmas bounded by a separatrix closed or open divertor geometry allows a factor of 2--3 better confinement times than in comparable limiter discharges. First H-mode results in JET at plasma currents of up to 3MA and with neutral beam injection (NBI) heating up to 10MW were presented at the IAEA conference in Kyoto, 1986. Since then, the possibility of applying differential currents in the main equilibrium coils has increased considerably the current capability of JET single null X-point discharges and H-mode operation has been extended to plasma currents of 5MA, full toroidal field of 3.4T and neutral beam powers of 20MW. With the global energy confinement time {tau}/sub E/ increasing roughly linearly with current (provided the safety factor at the 95% flux surface, q_{95} {approx←gt} 3) {tau}/sub E/ in the range 0.8--1s and stored plasma energies of more than 10MJ have been achieved with {approximately}10MW of additional heating. H-modes have also been obtained in the double null configuration with currents up to 3MA (technical limit {approx←lt} 4MA). The following discussion of JET H-mode results is restricted to NBI heating (80keV deuterium injection) of deuterium plasmas in a single null X-point configuration. Following a brief discussion of the operational limits for achieving H-modes, the paper addresses the characteristic features of JET H-mode plasmas. Part of this paper is devoted to energy confinement in JET H-mode plasmas, while another part addresses particle control and future prospects for H-mode operation. 23 refs., 15 figs.

12406 **(IPF—88-1) Neutron emission and dynamics of the POSEIDON plasma focus with an aluminium oxide insulator in the range 280-500 kJ.** Herold, H.; Kappeler, H.J.; Sadowski, M.; Schmidt, H.; Shakhatre, M. (Stuttgart Univ. (Germany, F.R.). Inst. fuer Plasmaforschung). Mar 1988. 19p. (In German). (CONF-8802115—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756373/JAW.

From Spring meeting of the Technical Committees of Extraterrestrial Physics, High-Speed Physics and plasma Physics of Deutsche Physikalische Gesellschaft e.V. (DPG); Duesseldorf, F.R. Germany (29 Feb 1988).

The POSEIDON plasma focus experiment could be decisively improved using an Al/sub 2/O/sub 3/ insulator, which inhibits the saturation point of neutron emission observed with the pyrex insulator. Increasing the bank energy from 280 kJ (60 kV) to 500 kJ (80 kV) raises the neutron emission, and avoids the drop of Y/sub n/ with successive shots of 80 kV. Currently, a neutron yield of 2.5x10/sup 11/ (at 80 kV) is achieved. The study reports on interferometric measurements of density in the compression plasma layer, and of its thickness, and furthermore on measurements of time-resolved electron temperature from -100 up to +200 nsec using pulsed (1 nsec) channel plates, and on impurities and their effects on layer structure and neutron emission.

12407 **(IPP—4/236) Kinetic-Alfven-wave current drive in plasmas with elongated cross sections.** Puri, S.; Wilhelm, R. (Association Euratom-Max-Planck-Institut fuer Plasmaphysik, Garching (Germany, F.R.)). (Max-Planck-Institut fuer Plasmaphysik, Garching (Germany, F.R.); Association Euratom-Max-Planck-Institut fuer Plasmaphysik, Garching (Germany, F.R.)). Sep 1988. 14p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756507/JAW.

Proper optimization of antenna parameters can lead to high efficiency (Rn/sub 20/ῖ/P > or approx. 3) kinetic-Alfven-wave current drive in plasmas with elongated cross sections. The optimal parameters include (i) finite, non-zero azimuthal wave number m = 1, (ii) large toroidal wave number n = 5-8, (iii) an antenna array consisting of a least n elements with adjacent elements phased $\pi/2$ apart, (iv) Faraday shielding, and (v) plasma cross section elongation s > 1.5, which together with the finite β, helps in moderating the trapped-particle effects by locating the resonance close to the plasma axis.

12408 **(IPP—III-137) Impurity transport studies in ASDEX by means of neon-seeded pellets.** Behringer, K.; Buechl, K. (Association Euratom-Max-Planck-Institut fuer Plasmaphysik, Garching (Germany, F.R.)). (Max-Planck-Institut fuer Plasmaphysik, Garching (Germany, F.R.); Association Euratom-Max-Planck-Institut fuer Plasmaphysik, Garching (Germany, F.R.)). Aug 1988. 18p. (IPP—1/246). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756508/JAW.

Neon-seeded deuterium pellets with a content of 1% neon have been successfully produced and injected into ASDEX divertor discharges. The behaviour of the deposited neon ions has been studied by VUV spectroscopy using a special version of the ASDEX/JET impurity transport code for interpretation. The neutral neon source has been modelled to resemble theoretical ablation curves. Estimates of time scales for ionisation and toroidal spreading of neon ions show that toroidal symmetry is established before ionisation to NeX, while the NeVIII burn-through must be treated with caution in a 1-d model. Some ionisation and recombination rate coefficients have been verified experimentally by investigation of the time delays between pellet entry and maximum intensities, and of the low remaining level of NeVIII radiation after its ionisation peak. The anomalous neon diffusion coefficient has been derived from the final decay of the NeX line intensity, which was observed to be exponential down to the 5% level. Below, recycling via the divertor chambers became important. A value D ≃ 0.4 m/sup 2//s was found if an associated drift velocity v/sub D/ = -2.D.r/a/sup 2/ was assumed, which is in good a agreement with the results of other transport studies of ASDEX OH-plasmas. No apparent dependence of the diffusion coefficient on electron density was observed.

12409 **(Juel—2226) Linear theory of the tearing instability in axisymmetric toroidal devices.** Rogister, A.; Singh, R. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Plasmaphysik; Association Euratom-Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.)). Aug 1988. 79p. NTIS (US Sales Only), PC A05/MF A01. Order Number DE88756378/JAW.

We derive a very general kinetic equation describing the linear evolution of low m/l modes in axisymmetric toroidal plasmas with arbitrary cross sections. Included are: Ion sound, inertia, diamagnetic drifts, finite poloidal beta, and finite ion Larmor radius effects. Assuming the magnetic surfaces to form a set of nested tori with circular cross sections of shifted centers, and introducing adequate simplifications justified by our knowledge of experimental tokamak plasmas, we then obtain explicitely the sets of equations describing the coupling of the quasimodes 0/1, 1/1, 2/1, and, for $m \geqq 2$, m/1, (m+1)/1. By keeping finite aspect ratio effects into account when calculating the jump of the derivative of the eigenfunction, it is shown that the theory can explain the rapid evolution, within one sawtooth period, of the growth rate of the sawteeth precursors from resistive values to magnetohydrodynamic ones. The characteristics thus theoretically required from current profiles in sawtoothing discharges have clearly been observed. Other aspects of the full theory could be relevant to the phenomenon of major disruptions.

12410 **(KFK—4433) Possibilities for breakeven and ignition of D-/sup 3/He fusion fuel in a near term tokamak. Final report.** Emmert, G.A.; El-Guebaly, L.; Kulcinski, G.L.; Santarius, J.F.; Scharer, J.E.; Sviatoslavsky, I.N.; Walstrom, P.L.; Klinghoefer, R.; Wittenberg, J.L. (Wisconsin Univ., Madison (USA); Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Kernverfahrenstechnik). (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Projekt Kernfusion; Fusion Power Associates, Gaithersburg, MD (USA); Wisconsin Univ., Madison (USA); Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Kernverfahrenstechnik). Sep 1988. 151p. (FPA—88-2). NTIS (US Sales Only), PC A08/MF A01. Order Number DE88756516/JAW.

The recent realization that the moon contains a large amount of the isotope /sup 3/He has rekindled interest in the D-/sup 3/He fuel cycle. In this study we consider the feasibility of investigating D-/sup 3/He reactor plasma conditions in a tokamak of the NET/INTOR class. We have found that, depending on the energy confinement scaling law, energy breakeven may be achieved without significant modification to the NET design. The best results are for the more optimistic ASDEX H-mode scaling law. Kaye-Goldston scaling with a modest improvement due to the H-mode is more pessimistic and makes achieving breakeven more difficult. Significant improvement in Q (ratio of the fusion power to the injected power), or the ignition margin, can be achieved by taking advantage of the much reduced neutron production of the D-/sup 3/He fuel cycle. Removal of the tritium producing blanket and replacing the inboard neutron shield by a thinner shield optimized for the neutron spectrum in D-/sup 3/He allows the plasma to be increased without changing the magnetic field at the toroidal field magnet. This allows the plasma to achieve higher beta and Q values up to about 3. The implications of D-/sup 3/He operation for fast ion loss, neutron shielding, heat loads on the first wall and divertor, plasma refuelling, changes to the poloidal field coil system, and pumping of the helium from the vacuum chamber are considered in the report.

12411 **(ORNL—6452) Fusion Energy Division: Annual progress report, period ending December 31, 1987.** Morgan, O.B. Jr.; Berry, L.A.; Sheffield, J. (Oak Ridge National Lab., TN (USA)). Nov 1988. Contract AC05-84OR21400. 395p. NTIS, PC A17/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005704/JAW.

The Fusion Program of Oak Ridge National Laboratory (ORNL), a major part of the national fusion program, carries out research in nearly all areas of magnetic fusion. Collaboration among staff from ORNL, Martin Marietta Energy Systems, Inc., private industry, the academic community, and other fusion laboratories, in the United States and abroad, is directed toward the development of fusion as an energy source. This report documents the program's achievements during 1987. Issued as the annual progress report of the ORNL Fusion Energy Division, it also contains information from components of the Fusion Program that are external to the division (about 15% of the program effort). The areas addressed by the Fusion Program include the following: experimental and theoretical research on magnetic confinement concepts, engineering and physics of existing and planned devices, development and testing of diagnostic tools and techniques in support of experiments, assembly and distribution to the fusion community of databases on atomic physics and radiation effects, development and testing of technologies for heating and fueling fusion plasmas, development and testing of superconducting magnets for containing fusion plasmas, and development and testing of materials for fusion devices. Highlights from program activities are included in this report. 126 figs., 15 tabs.

12412 **(UCRL—21130) Physics modeling support for the International Thermonuclear Experimental Reactor: Final report.** (Lawrence Livermore National Lab., CA (USA); TRW Space and Technology Group, Redondo Beach, CA (USA)). 30 Sep 1988. Contract W-7405-ENG-48. 339p. NTIS, PC A15/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005545/JAW.

There are two major sections to this report. The first section of the report is an executive summary of the work done this year. For each task, the major results are condensed for the reader's convenience. The major result of each memo, report or presentation is summarized briefly in this section. The second section of the report is a collection of appendices containing reports, memos, and presentations written this year. Here, the interested reader can investigate any topic discussed in the summary in more detail. The documentation is presented in chronological order, and we would like to note that the content of later documents may supercede that of earlier ones. The summaries are divided into sections, corresponding to the tasks outlined in the original proposal for the work. These sections are: MUMAK code development and application; Alfven wave stability problem; TETRA systems code development and application; lower hybrid heating and current drive; and advanced blanket modeling.

12413 **(UCRL—98670-Rev.1) A non-inductively driven tokamak reactor based on ITER.** Fenstermacher, M.E.; Devoto, R.S.; Bulmer, R.H.; Lee, J.D.; Miller, J.R.; Schultz, J.H. (Lawrence Livermore National Lab., CA (USA)). 1 Dec 1988. Contract W-7405-ENG-48. 7p. (CONF-881031—20-Rev.1). NTIS, PC A02/MF A01 - OSTI. Order Number DE89005097/JAW.

From 8. topical meeting on technology of fusion energy; Salt Lake City, UT, USA (9 Oct 1988).

The physics and engineering guidelines for the ITER device are shown to lead to viable physics operating points for a steady state tokamak power reactor. Non-inductive current drive is provided in steady state by high energy neutral beam injection in the plasma core, lower hybrid slow waves in the outer regions of the plasma and bootstrap current. Plasma gain Q({equivalent←to}fus ion power/input power) in excess of 20 and average neutron wall loading, $<\Gamma> \sim 2.0$ MW/m² are predicted in a device with major radius, $R_o = 7.5$ m and minor radius, $a = 2.8$ m. 15 refs., 3 figs., 3 tabs.

12414 **Magnetic island formation in three-dimensional plasma equilibria.** Hegna, C.C.; Bhattacharjee, A. (Department of Applied Physics, Columbia University, New York, New York 10027). *Physics of Fluids B: Plasma Physics;* **1**: No. 2, 392-397(Feb 1989).

The formation of magnetic islands as a result of plasma pressure in three-dimensional equilibria is investigated by a boundary-layer analysis. Away from a rational surface ("exterior region"), the plasma current is calculated exactly from the equilibrium equations. The singularity in the current thus calculated is resolved by analysis of the equilibrium equations in the vicinity of the rational surface ("inner region"). The Δ' parameter of tearing mode theory is used to match the inner and outer regions. The island width is found to depend on the resistive interchange criterion, as seen in the work of Glasser, Greene, and Johnson [Phys. Fluids 18, 875

(1975)]. Estimates of island sizes for different stellarator experiments are given.

12415 **Modification of sawteeth by second harmonic electron-cyclotron heating in a tokamak.** Snider, R.T.; Content, D.; James, R.; Lohr, J.; Mahdavi, M.A.; Prater, R.; Stallard, B. (General Atomics, San Diego, California 92138-5608). *Physics of Fluids B: Plasma Physics;* 1: No. 2, 404-413(Feb 1989).

Electron-cyclotron heating, using second harmonic waves launched from the low field side, has a strong effect on sawteeth in the DIII-D tokamak [Plasma Physics and Controlled Nuclear Fusion Research, 1986 (IAEA, Vienna, 1987), Vol. I, p. 159]. There are two distinct methods and mechanisms for sawtooth period extension. In the first case a factor of 6 increase in sawtooth period, compared to that during Ohmic heating, occurs with electron-cyclotron heating (ECH) localized near the q = 1 surface. The sawtooth period increases faster than linearly with increasing ECH power. Qualitatively, there is agreement with sawtooth suppression models, although details of the accompanying m/n = 1/1 oscillation appear inconsistent. The second case is a technique for complete sawtooth suppression in which impurities and off-axis heating broaden the current profile and drive $q_0 > 1$. It appears that the temperature and the current and q profiles inside q = 1 are determined by the magnetohydrodynamic activity, which is modified by ECH, and not by the ECH power deposition directly.

12416 **Current relaxation time scales in toroidal plasmas.** Mikkelsen, D.R. (Plasma Physics Laboratory, Princeton University, Princeton, New Jersey 08544). *Physics of Fluids B: Plasma Physics;* 1: No. 2, 333-339(Feb 1989).

An approximate normal mode analysis of plasma current diffusion in tokamaks is presented. The work is based on numerical solutions of the current diffusion equation in cylindrical geometry. Eigenvalues and eigenfunctions are shown for a broad range of plasma conductivity profile shapes. Three classes of solutions are considered that correspond to three types of tokamak operation. Convenient approximations to the three lowest eigenvalues in each class are presented, and simple formulas for the current relaxation time scales are given and applied to several cases of simple current relaxation as well as noninductive current drive. Simulations of current relaxation with and without current redistribution caused by a "sawtooth" model show that sawteeth can considerably shorten the relaxation time if the sawtooth region extends to $r \sim a/2$.

12417 **Bispectrum and three-wave coupling between fast magnetosonic waves and interchange modes.** Intrator, T.; Meassick, S.; Browning, J.; Majeski, R.; Hershkowitz, N. (Department of Nuclear Engineering and Engineering Physics, University of Wisconsin, Madison, Wisconsin 53706). *Physics of Fluids B: Plasma Physics;* 1: No. 2, 271-273(Feb 1989).

The bispectrum is used to demonstrate that wave—wave coupling occurs when ponderomotive forces due to wave fields in the ion cyclotron range of frequencies are used to stabilize a magnetized plasma column against magnetohydrodynamic (MHD) interchange instabilities. The three waves that interact resonantly are an applied wave, a MHD wave, and the nonlinearly coupled sideband wave. The net ponderomotive forces contain partially canceling and augmenting contributions from each induced sideband field.

12418 **Maximum beta for a small-aspect-ratio tokamak.** Holmes, J.A.; Charlton, L.A.; Hogan, J.T.; Carreras, B.A.; Lazarus, E.A. (Oak Ridge National Laboratory, Oak Ridge, Tennessee 37831). *Physics of Fluids B: Plasma Physics;* 1: No. 2, 358-363(Feb 1989).

Ideal linear magnetohydrodynamic (MHD) stability calculations demonstrate reasonable adherence at low aspect ratio (A/sub R/ < 2) to the Troyon scaling relationship for maximum beta, resulting in a broad regime of stable high-beta equilibria. For a specific low-aspect-ratio case (A/sub R/ = 5/3), a wide range of stable equilibria having volume-averaged beta, $<\beta>$, in excess of 20% is found. A systematic approach for estimating the maximum beta is used. First, the aspect ratio is reduced, for fixed shape and profiles, starting from the Troyon optimized case at A/sub R/ = 2.5; the plasma cross-section shape is then varied for fixed profiles at fixed A/sub R/ = 5/3; and finally, pressure and safety factor profiles are varied for fixed shape and aspect ratio. The calculations are carried out for low n (n = 1—3), usually with a conducting wall at a radius of 1.5 times the plasma minor radius, for n = ∞ ballooning modes, and for Mercier stability. Several additional "spot checks" on the effects of moving the conducting wall to infinity and of the stability of n = 0 and n = 4 and 5 modes indicate good stability properties for these, also. The calculations presented here demonstrate a straightforward extrapolation of the Troyon scaling formula to low aspect ratio, in spite of qualitative differences previously noted in low-aspect-ratio equilibria.

12419 **Nonlinear tearing modes in the reversed field pinch.** Miller, G. (Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Physics of Fluids B: Plasma Physics;* 1: No. 2, 384-391(Feb 1989).

Finite-amplitude islands, which are the saturated states of tearing modes in the reversed field pinch, are calculated. These states are bifurcated noncylindrical equilibrium states. With $\sigma(r)$ (σequivalentj x B/B^2) nonuniform across the plasma, as is consistent with experiment, a variety of m = 1 and m = 0 bifurcated equilibria are possible, instead of just the m = 1 helix calculated for uniform $\sigma(r)$ by Taylor [in Pulsed High Beta Plasmas, edited by D. Evans (Pergamon, Oxford, 1976), p. 59]. Assuming the magnetic field lines in the reversed field pinch are weakly stochastic, the growth time of an unstable tearing mode is on the inertial time scale, as in the Taylor model, in constrast to growth on the resistive time scale predicted from nonlinear tearing mode theory when magnetic surfaces exist. The dependence of the saturated island width on radius of a conducting shell is investigated. Islands in the reversed field pinch often have magnetic wells in the island interior, which may result in improved confinement in the island regions.

12420 **Effect of plasma noise spectrum on stimulated scattering in inhomogeneous plasma.** Berger, R.L.; Williams, E.A.; Simon, A. (KMS Fusion, Inc., 3621 S. State Road, P.O. Box 1567, Ann Arbor, Michigan 48106). *Physics of Fluids B: Plasma Physics;* 1: No. 2, 414-421(Feb 1989).

The flux of radiation emitted from an inhomogeneous plasma by stimulated Raman and Brillouin scattering is calculated with a source that includes both bremsstrahlung and longitudinal plasma wave noise sources. Significant enhancement of the flux above that found for a bremsstrahlung source alone are found for stimulated Brillouin scattering and for nonthermal but stable velocity distributions.

12421 **Parabolic approximation method for the mode conversion-tunneling equation.** Phillips, C.K.; Colestock, P.L.; Hwang, D.Q.; Swanson, D.G. (Plasma Physics Laboratory, Princeton University, Princeton, New Jersey 08544). *Physics of Fluids B: Plasma Physics;* 1: No. 2, 340-349(Feb 1989).

The derivation of the wave equation that governs ion cyclotron range of frequencies (ICRF) wave propagation, absorption, and mode conversion within the kinetic layer in tokamaks has been extended to include diffraction and focusing effects associated with the finite transverse dimensions of the incident wave fronts. The kinetic layer considered consists of a uniform density, uniform temperature slab model in which the equilibrium magnetic field is oriented in the z-italic-circumflex direction and varies linearly in the x-italic-circumflex direction. An equivalent dielectric tensor, as well as a two-dimensional energy conservation equation, are derived from the linearized Vlasov—Maxwell system of equations. A generalized, but approximate form of the mode conversion-tunneling equation is then extracted from the Maxwell equations, using the parabolic approximation method in which transverse variations of the wave fields are assumed to be weak in comparison to the variations in the primary direction of propagation. Numerical solutions of this approximate wave equation agree well with solutions to the exact wave equation within the kinetic layer.

12422 Fiber ablation in the solid deuterium Z pinch. Lindemuth, I.R.; McCall, G.H.; Nebel, R.A. (Inertial Fusion and Plasma Theory Group, Applied Theoretical Physics Division, Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Physical Review Letters;* **62**: No. 3, 264-267(16 Jan 1989).

We have performed one-dimensional magnetohydrodynamic computer calculations of the formation and evolution of the solid deuterium fiber Z pinch. With use of tabulated atomic data base and "cold start" initial conditions, our computations show that current is carried by hot plasma which has been ablated from the solid fiber. The computations suggest that the experimentally observed instability growth may coincide with the complete ablation of the central fiber.

12423 Effect of anisotropy on the ion-temperature-gradient instability. Mathey, O.; Sen, A.K. (Department of Applied Physics and Nuclear Engineering, Columbia University, New York, New York 10027). *Physical Review Letters;* **62**: No. 3, 268-271(16 Jan 1989).

It is shown that anisotropy in gradient has a substantial effect on the ion-temperature-gradient—driven mode. A gradient in the parallel temperature is needed for an instability to occur, and a gradient in the perpendicular temperature can either enhance or diminish the instability. The latter may be the basis for a stabilization scheme for this mode in tokamaks via strong and appropriate ion-cyclotron-resonance heating. The physical reason for this important role difference is presented.

12424 Demonstration of collisionally enhanced degenerate four-wave mixing in a plasma. Kitagawa, Y.; Savage R.L. Jr.; Joshi, C. (Electrical Engineering Department, University of California, Los Angeles, California 90024). *Physical Review Letters;* **62**: No. 2, 151-154(9 Jan 1989).

Experimental evidence for degenerate four-wave mixing in a plasma is presented for the first time. The thermal force contribution to the signal reflectivity, as evidenced by its temporal shape and dependence on plasma density, pump and probe intensities, and polarizations, dominates that due to the ponderomotive force in the collisional plasma. The pump-pump grating, which is driven by a much stronger ponderomotive force, is found not to affect adversely the signal reflectivity.

12425 High density plasmas produced by ultrafast laser pulses. Murnane, M.M.; Kapteyn, H.C.; Falcone, R.W. (Physics Department, University of California at Berkeley, Berkeley, California 94720). *Physical Review Letters;* **62**: No. 2, 155-158(9 Jan 1989).

We describe temporal and spectroscopic measurements of high-density plasmas produced by focusing intense, 160-fsec laser pulses on solids. Soft x-ray emission with a duration of 2 +- 2 psec is observed up to photon energies of a kilovolt. We observe reduced emission from long-lived spectral lines, indicating the presence of a short-lived, high-density plasma. Reflectivity measurements indicate that absorption of the laser pulse occurs at the surface of the solid before it expands.

12426 Electron Fokker-Planck equation for collisions with ions in a magnetized plasma. Ware, A.A. (Institute for Fusion Studies, The University of Texas at Austin, Austin, Texas 78712). *Physical Review Letters;* **62**: No. 1, 51-54(2 Jan 1989).

For those electrons whose Larmor radius is less than the Debye length, by averaging over binary collisions with ions and using a guiding-center approximation, a simple collision operator has been obtained which reproduces accurately the moments obtained from the existing more complex operators.

12427 Kilovolt x-ray spectroscopy of a subpicosecond-laser-excited source. Cobble, J.A.; Kyrala, G.A.; Hauer, A.A.; Taylor, A.J.; Gomez, C.C.; Delamater, N.D.; Schappert, G.T. (Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Physical Review* [*Section*] *A: General Physics;* **39**: No. 1, 454-457(1 Jan 1989).

A subpicosecond laser is focused to 10/sup 17/ W/cm² to create an extremely transient Al plasma with a kV radiation time short compared to most of the excitation times. High-resolution spectroscopy is used to analyze the kV line emission from the He- and H-like ions and to determine that the plasma reaches a temperature near 1 keV and cools in less than 10 ps.

12428 Wave energy flow conservation for propagation in inhomogeneous Vlasov--Maxwell equilibria. Kull, H.J.; Berk, H.L.; Morrison, P.J. (Institute for Fusion Studies and Department of Physics, The University of Texas at Austin, Austin, Texas 78712). *Physics of Fluids B: Plasma Physics;* **1**: No. 1, 55-61(Jan 1989).

Wave energy flow conservation is demonstrated for Hermitian differential operators that arise in the Vlasov--Maxwell theory for propagation perpendicular to a magnetic field. The energy flow can be related to the bilinear concomitant, for a solution and its complex conjugate, by using the Lagrange identity of the operator. This bilinear form obeys a conservation law and is shown to describe the usual Wentzel--Kramers--Brillouin (WKB) energy flow for asymptotically homogeneous regions. The additivity and lack of uniqueness of the energy flow expression is discussed for a general superposition of waves with real and complex wave-numbers. Furthermore, a global energy conservation theorem is demonstrated for an inhomogeneity in one dimension and generalized reflection and transmission coefficients are thereby obtained.

12429 Power deposition and current drive by intense microwave beams in tokamaks. Kritz, A.H.; Smith, G.R.; Nevins, W.M.; Cohen, R.H. (Hunter College/City University of New York, New York, New York 10021). *Physics of Fluids B: Plasma Physics;* **1**: No. 1, 142-147(Jan 1989).

Electron trapping by intense wave electric fields can alter the power deposition of electron-cyclotron waves in a tokamak when high-power sources are employed. The effect of wave trapping is examined in a ray-tracing study that utilizes plasma and wave parameters appropriate for the Microwave Tokamak Experiment (MTX) [National Technical Information Service Document No. DE-88016919 (1986)]. It is found that while wave trapping does result in some degradation in the rate of power deposition, single-pass power deposition is expected to remain significant in MTX. In examining current drive for MTX, the influence of electron trapping in the magnetic wells of the tokamak equilibrium field is included. Relativistic and magnetic trapping effects reduce the driven current by 25% to 50%. This initial study does not include the effects of gradients in the magnetic field and wave vector and therefore provides lower bounds for the power deposition and driven current.

12430 Numerical simulation of ion cyclotron range of frequencies electron heating in the JET tokamak. Romero, H.A.; Scharer, J.E. (Department of Electrical and Computer Engineering, University of Wisconsin: Madison, Madison, Wisconsin 53706). *Physics of Fluids B: Plasma Physics;* **1**: No. 1, 252-254(Jan 1989).

An ion cyclotron range of frequencies (ICRF) full-wave code and an anisotropic quasilinear Fokker--Planck code are used to simulate the time-dependent rise in the electron and ion temperatures during a sawtooth period corresponding to initial Ohmic equilibrium conditions in the JET tokamak [in Plasma Physics and Controlled Nuclear Fusion Research, 1986 (IAEA, Vienna, 1987), Vol. 1, p. 44]. Results from the 1-D power deposition studies indicate that less than 10% of the launched fast wave energy is directly absorbed by the electrons via transit time damping and mode conversion processes over a wide range of the JET plasma equilibrium parameters and wave spectrum. In contrast, the Fokker--Planck results indicate a very fast time scale for the formation of energetic minority tail ions which slow down primarily on electrons. It is concluded that the process of minority ion tail formation and electron drag best explains the experimentally observed rates of electron heating as seen in JET. To further substantiate this point, numerical Fokker--Planck results are presented that yield time-dependent electron and ion temperature rises, which are in good agreement with central core experimental measurements for the appropriate range of observed ICRF power density, energy confinement time, and plasma and wave parameters.

12431 **Exact and almost exact solutions to the Vlasov--Maxwell system.** Mahajan, S.M. (Institute for Fusion Studies, The University of Texas at Austin, Austin, Texas 78712). *Physics of Fluids B: Plasma Physics;* **1**: No. 1, 43-54(Jan 1989).

Exact and almost exact solutions to the Vlasov--Maxwell systems describing a variety of plasma configurations with density, temperature, and current gradients are presented. Possible consequences of these solutions are also discussed.

12432 **Plasma collection by an obstacle.** Vu, H.X.; Gould, R.W. (Watson Laboratory of Applied Physics, California Institute of Technology, Pasadena, California 91125). *Physics of Fluids B: Plasma Physics;* **1**: No. 1, 68-71(Jan 1989).

Plasma flow to an obstacle is examined using the two-fluid equations. In this model the obstacle is assumed to be a two-dimensional strip that extends to infinity in the y direction (slab geometry). An obstacle inserted into a magnetized plasma will cast a "shadow" along the magnetic field lines. The natural collection length of such an obstacle is a measure of the length of its shadow. This study shows that in a typical fusion tokamak, where c/sub s// Ω/sub c//sub i/d<<1 (Ω/sub c//sub i/, c/sub s/ are the ion cyclotron frequency and the ion acoustic speed, respectively, d is the half-width of the strip), the particle collection length of an obstacle can be approximated as L/sub parallel/ = 0.23c/sub s/d²/ D/sub perpendicular/, if D/sub perpendicular// c/sub s/d <<1; or 0.30d, if D/sub perpendicular// c/sub s/d >>1. For the cases examined in this study, the inclusion of the electron--ion collisional drag parallel to B_0 changes the solution only by an insignificant amount.

12433 **Fluctuation spectrum of resistive pressure-gradient-driven turbulence.** Lee, G.S.; Carreras, B.A.; Garcia, L. (Oak Ridge National Laboratory, Oak Ridge, Tennessee 37831-8071). *Physics of Fluids B: Plasma Physics;* **1**: No. 1, 119-133(Jan 1989).

The spatial structure of resistive pressure-gradient-driven turbulence is studied analytically with renormalized two-point spectrum equations and numerically by multihelicity nonlinear calculations. The wavenumber spectra for the pressure fluctuations and electrostatic potential fluctuations have been calculated with spectral analysis techniques. The least-squares fit of the numerically calculated wavenumber spectrum to a power law yields a pressure fluctuation spectrum <p-italic-tilde²>/sub m/{similar←to}m/sup -(2.4//sup +- //sup 0.4)/ and an electrostatic potential fluctuation spectrum <phi-tilde²>/sub m/{similar←to}m/sup -(4.3//sup +- //sup 0.3)/. These results agree with the predictions of the analytic theory. The power-law decay indexes of energylike spectra show the three-dimensionality of resistive pressure-gradient-driven turbulence, even in a plasma with a strong axial magnetic field. This characteristic of resistive fluid turbulence arises from the important role of the resistivity as an integral part of plasma turbulence and differentiates the resistive plasma turbulence from the homogeneous fluid turbulence.

12434 **Bootstrap current and parallel viscosity in the low collisionality regime in toroidal plasmas.** Shaing, K.C.; Crume E.C. Jr.; Tolliver, J.S.; Hirshman, S.P.; van Rij, W.I. (Fusion Energy Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee 37831). *Physics of Fluids B: Plasma Physics;* **1**: No. 1, 148-152(Jan 1989).

Bootstrap currents in the low collisionality regime in nonaxisymmetric toroidal plasmas are calculated analytically using a model drift kinetic equation. The results obtained using the analytic expression are compared with those calculated from the numerical solutions of the drift kinetic equation. Qualitatively and quantitively, the results are in reasonable agreement.

12435 **Pressure and potential fluctuation measurements in the interior of a tokamak plasma.** Saadatmand, K.; Crowley, T.P.; Hickok R.L. Jr. (Electrical, Computer, and Systems Engineering Department, Rensselaer Polytechnic Institute, Troy, New York 12180-3590). *Physics of Fluids B: Plasma Physics;* **1**: No. 1, 164-169(Jan 1989).

Fluctuations in electric potential, electron pressure, and their relative phase have been measured in the RENTOR tokamak [Phys. Rev. Lett. 55, 2417 (1985)] using a heavy ion beam probe. Between 70 and 200 kHz, pressure fluctuation levels of p-italic-tilde/p{similar←to}0.04 and potential fluctuation levels of ephi-tilde/T/sub e/ = 0.08--3 have been observed. The phase angle between the pressure and potential fluctuations is approximately 25°. The heat transport by the observed fluctuations is not enough to account for the observed heat loss at the plasma edge. The RENTOR results are compared with measurements on the TEXT (J. Forster, Ph.D. thesis, Rensselaer Polytechnic Institute, 1987) and ISX-B [Phys. Rev. Lett. 59, 1301 (1987)] tokamaks and with drift wave and rippling mode theories.

12436 **Dynamics of magnetic relaxation in a high-temperature, current-carrying plasma.** Lee, G.S.; Diamond, P.H.; An, Z.G. (Oak Ridge National Laboratory, Oak Ridge, Tennessee 37831-8071). *Physics of Fluids B: Plasma Physics;* **1**: No. 1, 99-108(Jan 1989).

The results of a study of the role of multiple-helicity nonlinear interaction of tearing modes and the dynamics of magnetic relaxation and dynamo activity in a high-temperature, current-carrying plasma are described. A set of fluid equations for tearing modes in the semicollisional regime is derived, and a previous resistive magnetohydrodynamic study of tearing mode turbulence is thus extended to high-temperature regimes. Because of the direct connection between fluctuation evolution and configuration evolution, a generalized nonlinear theory of the turbulent dynamo and magnetic relaxation is proposed, and a two-point <(del/sub perpendicular/p-italic-tilde)psi-tilde>-correlation evolution is determined by calculating the relaxation time tau/sub cl/. This calculated relaxation time is shown to serve as the phase shift between v-italic-tilde/sub r/ and psi-tilde and hence to control magnetic energy relaxation and dynamo processes. Careful study of the two separated regions of kink-tearing modes (i.e., the resonant region and the exterior region) reveals the direct relationship between the equilibrium magnetic energy relaxation and average magnetic flux evolution. Thus a theoretical interpretation of the observed correlation between magnetic fluctuations and maintenance of field reversal is provided. Finally, the correlation lifetime of the flux transport term is evaluated from the renormalized two-point theory, and the saturated magnetic fluctuation level is estimated. The result shows that the saturation level is independent of or very weakly dependent on the Lundquist number S. The implications of this result for anomalous thermal transport and dynamo activity in high-temperature reversed field pinch experiments are discussed.

12437 **Toroidal ion-pressure-gradient-driven drift instabilities and transport revisited.** Biglari, H.; Diamond, P.H.; Rosenbluth, M.N. (Department of Physics B-019, University of California at San Diego, La Jolla, California 92093 and General Atomics, San Diego, California 92138). *Physics of Fluids B: Plasma Physics;* **1**: No. 1, 109-118(Jan 1989).

A unified theory of ion-pressure-gradient-driven drift wave instabilities and transport is presented, which ties the long-wavelength trapped-ion mode to the moderate-wavelength hydrodynamic mode in toroidal geometry. An analytic dispersion relation that retains ion drift resonances, and keeps the leading-order contribution from finite Larmor radius effects and parallel compressibility, is derived. Results indicate that the slab and toroidal branches of these instabilities are of comparable importance, and are both strong candidates to explain the observed anomalous ion loss in toroidal fusion devices. However, it is concluded that in the limit of flat-density profiles characteristic of H-mode discharges, the stabilizing influence of perpendicular compressibility is insufficient to corroborate an improvement, if any, in ion confinement quality. Mixing-length expressions for the fluctuation amplitudes and both electron and ion transport coefficients are derived. Results also indicate that the heretofore experimentally observed favorable current scaling of the energy confinement time may saturate in low ion-collisionality discharges. Finally, it is shown that a population of energetic trapped particles, such as those that may be produced during radio frequency or perpendicular neutral beam heating, can significantly exacerbate the instability. Several suggestions for experiments are made to help in differentiating among various anomalous transport scenarios.

12438 Incompressible description of Rayleigh--Taylor instabilities in laser-ablated plasmas. Kull, H.J. (Institute for Fusion Studies, The University of Texas at Austin, Austin, Texas 78712). *Physics of Fluids B: Plasma Physics;* **1**: No. 1, 170-182(Jan 1989).

An incompressible fluid model of the ablative Rayleigh--Taylor instability [Phys. Fluids 29, 2067 (1986)] is generalized to include self-consistent diffuse boundaries. With diffuse boundaries the incompressible model is found to be in excellent agreement with a number of previous stability studies of laser ablation. The present theory can predict the scaling of the instability cutoff over an extended parameter range and its dependence on the heat conduction law. It is found that more favorable stability behavior can be obtained both for weak and strong thermal diffusion. Furthermore a strong dependence of the stabilization mechanism on the functional form of the heat conductivity is indicated. Representative conditions for laser ablation are identified and discussed in detail.

12439 Coupling of stimulated Raman and Brillouin scattering in a plasma. Umstadter, D.; Mori, W.B.; Joshi, C. (University of California, Los Angeles, California 90024). *Physics of Fluids B: Plasma Physics;* **1**: No. 1, 183-187(Jan 1989).

The observation of an anti-Stokes satellite in the spectrum of light backscattered from a CO_2 laser plasma is reported. Its origin is found to be Thomson scattering of the incident light from a counterpropagating mode-coupled plasma wave. The parent electron and ion waves in the mode-coupling process were driven by stimulated Raman and Brillouin backscattering. The parent and daughter plasma waves were detected by ruby laser Thomson scattering. A computer simulation modeling the experiment shows further cascading of the Stokes backscattered light to lower frequencies, apparently a result of its rescattering from another, higher phase velocity, counterpropagating coupled mode. Comparisons with theoretical predictions are presented.

12440 Experimental measurement of three-wave coupling and energy cascading. Ritz, C.P.; Powers, E.J.; Bengtson, R.D. (The University of Texas at Austin, Austin, Texas 78712). *Physics of Fluids B: Plasma Physics;* **1**: No. 1, 153-163(Jan 1989).

The nonlinear coupling coefficient and the energy transfer associated with three-wave interactions are computed from measured data of the turbulent edge plasma of the Texas Experimental Tokamak(TEXT) [Nucl. Technol. Fusion 1, 479 (1981)]. The results show the presence of three-wave interactions. The interactions cause energy to cascade away from the dominant waves of the spectrum primarily toward lower, but also toward higher frequencies. The results are obtained with a new digital spectral analysis technique based on the estimation of higher-order cumulants. The method is discussed and tested on a simulation experiment. The same technique is useful for neutral fluids as well.

12441 Phase-inflection parametric instability behavior near threshold with application to laser--plasma stimulated Raman scattering (SRS) instabilities in exploding foils. Williams, E.A.; Johnston, T.W. (Lawrence Livermore National Laboratory, Livermore, California 94450). *Physics of Fluids B: Plasma Physics;* **1**: No. 1, 188-194(Jan 1989).

Previous absolute instability results for significant growth from a parametric instability involving oppositely directed modes coupled by a uniform pump with phase inflection coupling ($\Delta k = k''x^2/2$) are extended to higher modes and to thresholds. The results are applied to stimulated Raman scattering experiments done with exploding foils.

7002 Fusion Power Plant Technology

REFER ALSO TO CITATION(S) 10759, 10838, 11128, 11336, 11411, 12392, 12410, 12438, 12500

12442 (CEA-CONF—9420) Fuel clean-up: poisoning of palladium-silver membranes by gaseous impurities. Sannier, J. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Inst. de Recherche Technologique et de Developpement Industriel (IRDI)). 1988. 5p. (CONF-880505—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88756216/JAW.

From 3. topical meeting on tritium technology in fission, fusion and isotopic applications; Toronto, Canada (1 May 1988).

The feasibility of a permeation process using a palladium-silver alloy membrane, to separate deuterium and tritium from fusion reactor gaseous wastes needs demonstration owing to poisoning effects of impurities. A parametric investigation of the poisoning by the most important expected gaseous impurities (C0, C0/sub 2/ and CH/sub 4/) is carried out with the loop PALLAS, in function of membrane temperature (100 to 450/sup 0/C), H/sub 2/ pressure (0.3 to 14 kPa) and impurity concentration (0.2 to 9.5 vol. %). The poisoning effect of C0 is a concern for the process while C0/sub 2/ and CH/sub 4/ appear to have no practical effect on the permeation rate. Depending on C0 concentration optimal operating temperatures of the membrane should lie between 250 and 375/sup 0/C limits.

12443 (CFFTP-G—86037) Low-risk aqueous lithium salt blanket for engineering test reactors. Gierszewski, P.; Deutsch, L.; Embrechts, M.; Steiner, D. (Canadian Fusion Fuels Technology Project, Toronto, Ontario; Grumman Aerospace Corp., Bethpage, NY (USA). Research Dept.; Rensselaer Polytechnic Inst., Troy, NY (USA)). (Canadian Fusion Fuels Technology Project, Toronto, Ontario). Sep 1986. 7p. (CONF-860917—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88705022/JAW.

From 14. SOFT - symposium on fusion technology; Avignon, France (8 Sep 1986).

A simple blanket concept is proposed based on 1-3 wt.% lithium dissolved as a salt in low temperature (80 degrees C) and low pressure (0.1 MPa) water. This concept can provide, for example, a 0.5 tritium breeding ratio with 60% steel structure and 70% coverage. The use of neutron multipliers, other structural materials (especially zirconium alloys), higher coverage and higher lithium salt concentrations allows tritium breeding ratios over unity if necessary. Other advantages of this concept include the simple shield-like geometry, substantial structural volume for mechanical strength, excellent heat transfer ability of water coolant, efficient neutron and gamma shielding through the combination of high-Z structure and low-Z water, and conventional tritium recovery and control technology. This concept could initially provide the shielding needs for an engineering test reactor and later, by the addition of lithium salt and tritium recovery systems, also provide tritium breeding. This staged operation and liquid breeder/coolant allows control over the tritium inventory in the device without machine disassembly. 14 refs.

12444 (CFFTP-G—86050) Concepts for fusion fuel production blankets. Gierszewski, P. (Canadian Fusion Fuels Technology Project, Toronto, Ontario). Jun 1986. 6p. (CONF-860613—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88705023/JAW.

From 26. annual international conference of the Canadian Nuclear Association and the 7. annual conference of the Canadian Nuclear Society; Toronto, Ontario, Canada (8 Jun 1986).

The fusion blanket surrounds the burning hydrogen core of the fusion reactor. It is in this blanket that most of the energy released by the DT fusion reaction is converted into useable product, and where tritium fuel is produced to enable further operation of the reactor. Blankets will involve new materials, conditions and processes. Several recent fusion blanket concepts are presented to illustrate the range of ideas.

12445 **(CFFTP-G—87016) Canadian Fusion Fuels Technology Project.** Dautovich, D.P.; Gierszewski, P.J.; Wong, K.Y.; Stasko, R.R.; Burnham, C.D. (Canadian Fusion Fuels Technology Project, Toronto, Ontario). Apr 1987. 17p. (CONF-8705358—). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88705024/JAW.

From Canadian Nuclear Society Conference; Montreal, Canada (18 May 1987).

The Canadian Fusion Fuels Technology Project (CFFTP) is a national project whose aim is to develop capability in tritium and robotics technologies for application to international fusion development programs. Activities over the first five years have brought substantial interaction with the world's leading projects such as Tokamak Fusion Test Reactor (TFTR), the Joint European Torus (JET), and the Next European Torus (NET), Canadian R and D and engineering services, and hardware are in demand as these major projects prepare for tritium operation leading to the demonstration of energy breakeven around 1990. Global planning is underway for the next generation ignition experiment. It is anticipated this will provide increased opportunity for CFFTP and its contractors among industry, universities and governmental laboratories.

12446 **(CONF-880812—34) Quench pressure, thermal expulsion, and normal zone propagation in internally cooled superconductors.** Dresner, L. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 3p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005668/JAW.

From Applied superconductivity conference; San Francisco, CA, USA (21 Aug 1988).

When a nonrecovering normal zone appears in an internally cooled superconductor, the pressure in the conductor rises, helium is expelled from its ends, and the normal zone grows in size. This paper presents a model of these processes that allows calculation of the pressure, the expulsion velocity, and the propagation velocity with simple formulas. The model is intended to apply to conductors such as the cable-in-conduit conductor of the Westinghouse LCT (WH-LCT) coil, the helium volumes of which have very large length-to-diameter ratios (3 {times} 10^5). The predictions of the model agree with the rather limited data available from propagation experiments carried out on the WH-LCT coil. 3 refs., 1 fig.

12447 **(DOE/ER/53198—130) Studies of a poloidal divertor reversed field pinch.** Sarff, J.S. (Wisconsin Univ., Madison (USA). Plasma Physics Research). Nov 1988. Contract FG02-85ER53198. 95p. NTIS, PC A04/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005498/JAW.

Several attempts have been made to form a reversed field pinch (RFP) in a four-node, poloidal divertor configuration which positions the plasma far from a conducting wall. In this configuration, the plasma is localized within a magnetic separatrix formed by the combination of toroidal currents in the plasma and four, internal, conducting rings. These experiments were conducted on three devices: Tokapole II, the Wisconsin Levitated Octupole, and the modified Octupole with smaller conducting rings. Transient, RFP-like equilibria were obtained on Tokapole II and the Wisconsin Levitated Octupole. RFP-like equilibria with field reversal duration {approximately}1 msec were obtained in the small ring Octupole. None of these plasmas was sustained against resistive magnetic diffusion. Local, internal measurements of the magnetic field in Tokapole II plasmas indicated the plasma current and density were mostly confined to the region inside the magnetic separatrix. The sharp drop in plasma pressure near the separatrix generated a large diamagnetic current in that region. Large magnetic perturbations observed in the startup phase of these plasmas. On the small ring Octupole, the perturbation was measured to have a dominant poloidal mode number of m = 1 and toroidal mode numbers n {approximately} {minus}5, i.e., internally resonant or nonresonant modes. This perturbation was stationary and was phase-locked to a magnetic field error. If the tenuous plasma region outside the separatrix is "vacuum-like," then this behavior might represent current-driven instability owing to the lack of nearly, stabilizing boundary. Such instability is consistent with linear magnetohydrodynamic stability calculations and nonlinear simulations of a cylindrical REP plasma bounded by a large vacuum region and a distant conducting wall. 53 refs., 48 figs.

12448 **(EGG-M—33187) Nuclear safety enhancements to the Compact Ignition Tokamak.** Holland, D.F.; Brereton, S.J.; Lyon, R.E.; FLeming, R.B.; Ku, L.P. (EG and G Idaho, Inc., Idaho Falls (USA)). 1988. Contract AC07-76ID01570. 19p. (CONF-880417—25). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005168/JAW.

From 1. international symposium on fusion nuclear technology (ISFNT); Tokyo, Japan (10 Apr 1988).

Safety analysis of the Compact Ignition Tokamak (CIT) is described. The CIT will use tritium and produce neutrons that will activate nearby structures and gases. Safety design objectives were established and risk assessment techniques were applied to early designs to determine the need for safety enhancements. Emphasis was placed on reducing inventories and use of passive safety systems. The current baseline design is described, as well as the safety enhancements. Safety aspects discussed in detail include the activated nitrogen in the cryostat, accidental tritium releases, seismic design standards, and waste management. Based on this safety assessment, the baseline design meets the design objectives. Benefits of this safety assessment early in the design include design improvements with enhanced safety and early identification of required safety research and testing. 5 refs., 5 figs., 2 tabs.

12449 **(EGG-M—34187) Implantation-driven tritium permeation in vanadium alloy fusion reactors.** Holland, D.F.; Anderl, R.A. (EG and G Idaho, Inc., Idaho Falls (USA)). 1988. Contract AC07-76ID01570. 7p. (CONF-880505—43). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005166/JAW.

From 3. topical meeting on tritium technology in fission, fusion and isotopic applications; Toronto, Canada (1 May 1988).

The safety concerns resulting from tritium implantation into vanadium and vanadium alloys have been studied. Tests were conducted to measure the physical constants that determine permeation and inventory in these materials. Surface recombination coefficients, enhancement factors due to plasma sputtering, and the diffusion constants were measured. To determine the implications of these results, application was made to the TITAN-I fusion reactor design. For this design, the tritium permeation rate and inventory buildup in the first wall were calculated for a range of surface conditions on the coolant side. 7 refs., 8 figs., 1 tab.

12450 **(EGG-M—88256) Explosion hazard in liquid nitrogen cooled fusion systems.** Brereton, S.J. (EG and G Idaho, Inc., Idaho Falls (USA)). 1988. Contract AC07-76ID01570. 6p. (CONF-881031—55). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005201/JAW.

From 8. topical meeting on technology of fusion energy; Salt Lake City, UT, USA (9 Oct 1988).

The explosion hazard associated with the use of liquid nitrogen in a radiation environment in fusion facilities has been investigated. The principal product of irradiating liquid nitrogen is thought to be ozone, resulting from the action of radiation on oxygen impurity. Ozone is a very unstable material, and explosions may occur as it rapidly decomposes to oxygen. Occurrences of this problem in irradiated liquid nitrogen systems are reviewed. An empirical expression, from early experiments, for the yield of ozone in liquid nitrogen-oxygen mixtures exposed to gamma radiation is employed to assess the degree of ozone explosion hazard expected at fusion facilities. The problem is investigated for the Compact Ignition Tokamak (CIT) as a particular example. 16 refs., 5 figs., 1 tab.

12451 **(EGG-M—88257) Safety comparison of fusion fuel cycles.** Brereton, S.J.; Massidda, J.E.; Kazimi, M.S. (EG and G Idaho, Inc., Idaho Falls (USA)). 1988. Contract AC07-76ID01570. 7p. (CONF-881031—54). NTIS, PC A02/MF A01 - OSTI. Order Number DE89005200/JAW.

From 8. topical meeting on technology of fusion energy; Salt Lake City, UT, USA (9 Oct 1988).

Potential safety advantages are achievable through the use of advanced fuel cycles, which eliminate the need to breed and fuel tritium, and produce fewer neutrons. In this work, the operational radiological hazards associated with the deuterium-tritium (DT), deuterium-deuterium (DD) and deuterium-helium-3 (DHe) fusion fuel cycles have been compared. The advanced fuels have a clear

advantage over the DT fuel cycle in terms of tritium hazard. In terms of activation and waste disposal hazards, the operational safety advantages of the advanced fuels are less clear, and appear to be strongly material dependent. 9 refs., 7 tabs.

12452 **(EGG-M—88273) Assessment of the MHD capability in the ATHENA code using data from the ALEX [Argonne Liquid Metal Experiment] facility.** Roth, P.A. (EG and G Idaho, Inc., Idaho Falls (USA)). 28 Oct 1988. Contract AC07-76ID01570. 5p. (CONF-881031—58). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005405/JAW.

From 8. topical meeting on technology of fusion energy; Salt Lake City, UT, USA (9 Oct 1988).

The ATHENA (Advanced Thermal Hydraulic Energy Network Analyzer) code is a system transient analysis code with multiloop, multi-fluid capabilities, which is available to the fusion community at the National Magnetic Fusion Energy Computing Center (NMFECC). The work reported here assesses the ATHENA magnetohydrodynamic (MHD) pressure drop model for liquid metals flowing through a strong magnetic field. An ATHENA model was developed for two simple geometry, adiabatic test sections used in the Argonne Liquid Metal Experiment (ALEX) at Argonne National Laboratory (ANL). The pressure drops calculated by ATHENA agreed well with the experimental results from the ALEX facility. 13 refs., 4 figs., 2 tabs.

12453 **(KFK—4488) Nuclear Fusion Project. Semi-annual report of the Association KfK/EURATOM. April 1988 - September 1988.** Kast, G. (comp.). (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Projekt Kernfusion; Commission of the European Communities, Brussels (Belgium)). Oct 1988. 95p. (EUR—11392-EN). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88756393/JAW.

Report on technology tasks: Blanket designs studies; Computational tools for neutronics; Corrosion and fatigue of structural materials in Pb-17Li; Tritium extraction from liquid Pb-17Li by the use of solid getters; Development of ceramic breeder materials; The large coil task; Development of high field composite conductors; Superconducting poloidal field coil development; Poloidal field coil for TORE SUPRA as NET-Prototype Coil; Structural materials Fatigue characterization at 4 K; Low electrical conductivity structures development; MANET 1; Pre- and post-irradiation fatigue properties and fracture toughness of 1.4914 martensitic steel; In-pile creep-fatigue testing of type 316 and 1.4914 steels; Ceramics for first-wall protection and for RF windows; Development of low activation ferritic-martensitic steels; Design study of plasma facing components and shield; Procedures and tools for structural design evaluation; Theory and tools for evaluation of magnetic field effects on liquid-metal breeder blankets; Studies of pebble beds of ceramic compounds; Background studies on remote maintenance; Handling equipment for in-vessel components; Safety aspects of the cryosystem and superconducting magnets; Overall plant accident scenarios and safety guidelines for NET; Generic environmental impact assessment for a fusion facility; Industrial development of large components for plasma exhaust pumping; Optimization of cryogenic vacuum pumping of helium; Plasma exhaust purification by means of cryosorption on molecular-sieves or alternative absorbents and use of hot-metal getters; Adsorption of DT on heated metal beds other than uranium; Catalyst development for the exhaust purification process; Development of ECRH power sources. NET study contracts: Availability of the LCT plant; Investigation of the vacuum and exhaust performation of NET; Study about the NET TF pancake test; Evaluation of crack growth delay in multilayer sheets.

12454 **(SAND—88-0422) Magnetic fusion energy program: Annual report 1987.** Doyle, B.L.; Whitley, J.B.; Wilson, K.L. (eds.). (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 128p. NTIS, PC A07 - OSTI. Order Number DE89004769/JAW.

This paper discusses activities in magnetically confined thermonuclear fusion energy research at Sandia National Laboratories. Topic covered are: facilities equipment; project and device support; Tokamak Fusion Test Reactor; compact ignition tokamak; International Thermonuclear Engineering Reactor; joint European torus; TEXTOR; tore supra; DIII-D, ASDEX and ASDEX upgrade; alternate concepts (mirror machines and ZT-40M); high-heat flux materials and components development; and plasma surface interactions research.

12455 **(UCRL—21134) Final design report, September 11, 1986.** (Lawrence Livermore National Lab., CA (USA); Gallagher Associates, Inc., West Lafayette, IN (USA)). Nov 1988. Contract W-7405-ENG-48. 8p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005543/JAW.

The task is to design the quasi-optical microwave components for each of five different optical paths within the MFTF-B machine. Each path contains two reflectors. The function of the two reflectors in each path is to modify the output field of a waveguide to a desired pattern within the plasma. For all five beam paths, the waveguide output is assumed to be a TE 01 mode as decided at the July 18, design review. Each optical train consists of two reflectors. The first reflector is an off axis paraboloid which focuses the beam. The first reflector also contains the groove pattern of the twist polarizer. The second reflector receives the polarized beam from the first reflector. The function of the second reflector is to modify the phase of the polarized wavefront received from the first reflector. This modification shapes the wavefront profile in the plasma.

12456 **(UCRL—98469-Rev.1) Rotating liquid blanket with no first wall for fusion reactors.** Moir, R.W. (Lawrence Livermore National Lab., CA (USA)). 18 Nov 1988. Contract W-7405-ENG-48. 6p. (CONF-881031—23-Rev.1). NTIS, PC A02/MF A01 - OSTI. Order Number DE89004813/JAW.

From 8. topical meeting on technology of fusion energy; Salt Lake City, UT, USA (9 Oct 1988).

A toroidal vortex of liquid FLiBe ($LiF + BeF_2$) is suggested for the blanket of a fusion reactor. Because this reactor chamber has no solid first wall, it might avoid many of the problems that accompany conventional blanket design. The liquid blanket is sustained by nozzles that inject a continuous layer of cool liquid on the inner surface. A second set of nozzles sends a stream of droplets across the diverted scrape-off layer or edge plasma to carry its heat away. The feasibility issues of most importance are judged to be avoiding turbulent breakup of the vortex and preventing too much contamination of the plasma by the evaporating FliBe. 7 refs., 5 figs., 1 tabs.

12457 **Electrostatic control of divertor flows in a stellarator.** Doerner, R.P.; Anderson, D.T.; Hitchon, W.N.G.; Matthews, P.G.; Shohet, J.L. (Torsatron/Stellarator Laboratory, University of Wisconsin—Madison, Madison, Wisconsin 53706). *Physical Review Letters;* **62**: No. 2, 159-162(9 Jan 1989).

An electrostatic method for controlling diverted particle fluxes in a stellarator has been demonstrated. Potentials applied to a defined set of divertor targets (shields) in contact with diverted flux bundles results in redistribution of plasma flow to any given divertor. Examination of the edge magnetic topology shows that E x B drifts just outside the last-closed magnetic surface account for the alteration of the diverted particle flows.

12458 **Rippled shock front solutions for testing hydrodynamic stability simulations.** Munro, D.H. (Lawrence Livermore National Laboratory, Livermore, California 94550). *Physics of Fluids B: Plasma Physics;* **1**: No. 1, 134-141(Jan 1989).

The response of a shock front to arbitrary small perturbations can be calculated analytically. Such rippled shock front solutions are useful for determining the accuracy of hydrodynamic simulation codes such as LASNEX [Comments Plasma Phys. Controlled Fusion 2, 51 (1977)], which are used to compute perturbation growth in inertial fusion targets. The LASNEX fractional errors are of order $\kappa^2 L^2$, where κ is the transverse wavenumber of the perturbation, and L is the largest zone dimension. Numerical

errors are about 25% for a calculation using 26 zones per transverse wavelength.

99 GENERAL AND MISCELLANEOUS

12459 **(ACUNS—88) Student research in Canada's north.** Admas, P. (ed.); Johnson, P.G. (ed.). (Association of Canadian Universities for Northern Studies (ACUNS), Ottawa, Ontario). 1988. 700p. (CONF-8511343—; MICROLOG—88-02606). Association of Canadian Universities for Northern Studies, 130 Albert Street, Ottawa, Ont., Canada K1P 5G4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

From National student conference on northern studies; Ottawa, Canada (18 Nov 1985).

A conference was organized in Canada to allow a large number of students with northern interests to meet together to present the results of their work and to discuss many other matters of mutual interset. In addition, this conference allowed students from many disciplines in the natural and social sciences to advance northern scholarship, and to foster a multidisciplinary approach to northern studies. A wide range of topics from the physical, biological, and social sciences were covered, including Inuit music, traditional medicine, mammoth bones, fossil trees, icebreaker design, archaeology, caves, naturally acid and other lakes, glaciers, bogs, Inuit clothing, education, northern parks, river ice jams, geology, marine science including large marine mammals, and global strategy. Separate abstracts have been prepared for twelve papers from this conference.

9901 Management

REFER ALSO TO CITATION(S) 10696, 11117

12460 **(CONF-881249—1) Optical storage: Financial management and budget applications.** Morris, J.D.; Emrich, M.L. (Oak Ridge National Lab., TN (USA)). Oct 1988. Contract AC05-84OR21400. 12p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004916/JAW.

From National Governor's Association meeting: finding the future conference; Washington, DC, USA (12 Dec 1988).

Recent optical storage technology advances have improved the micro-computer's ability to handle large quantities of data. This paper will explain the evolution of this technology including the state of the art. The factors involved in this evolution will be described, namely the division of research into three distinct areas: Compact Disk Read Only Memory (CD-ROM); Write Once Read Many (WORM); and Erasable Optical Storage (EOS). The future implications of these areas will be reported. In addition, practical applications that utilize optical media in the financial environment will be highlighted. 3 figs., 1 tab., 10 refs.

12461 **(CONF-890224—1) A telemetric monitoring and analysis system for use during large scale population evacuations.** Southworth, F.; Chin, S.M.; Cheng, P.D. (Oak Ridge National Lab., TN (USA)). Sep 1988. Contract AC05-84OR21400. 11p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89000434/JAW.

From International conference on road traffic monitoring; London, UK (7 Feb 1989).

In this paper the on-going development of an operational, prototype Real-time Traffic Monitoring and Analysis System (RTMAS) whose purpose is to record and warn of the build-up of significant urban population evacuations in times of threat is described. In tracking an evacuation build-up, RTMAS is being developed to collect and cumulate net traffic movements (i.e., net regional outflows), building up a quantitative picture of the timing and directions of an evacuation. This is information not currently available in any other form, other than data obtained from very small, and increasingly expensive, post-evacuation household interviews. 4 refs.

12462 **(DOE/CH—8801) Institutional quality assurance at DOE-CH Laboratories: "A Partnership".** (USDOE Chicago Operations Office, Argonne, IL). Jun 1988. 41p. H. Order Number DE89004763/JAW.

History suggests that human inspiration is rooted in goals more than methods. It is our longings that fire imagination but our processes that often quench the flames. This paper gives an account of the effort to build upon the quality traditions of the CH laboratories without sacrificing the creative spark that is the source of their human energy. Our objective is to ensure continued excellence in scientific and technical accomplishment in a world that rightfully demands meaningful assurance that the public support and trust afforded these national institutions is justified. It is not our expectation that this report will be viewed as the definitive statement much less the final word for the diverse needs of the Department. Rather, we offer this paper for consideration by others who face the same challenges. Even in the CH context alone we anticipate an evolutionary process as we proceed down the path we have marked for ourselves. This paper simply serves to declare that the Chicago partnership is aware of its responsibilities and is working to increase understanding and commitment as a foundation for progress. Members of the CH staff will be using this paper to generate expanded consensus and support among ourselves as well as Field and Headquarters colleagues and clients. Publication marks a beginning not an end in our effort to assure quality management of the Chicago laboratories. 4 refs.

12463 **(DOE/MA—0354) Department of Energy management improvement report.** (USDOE Assistant Secretary for Management and Administration, Washington, DC). Nov 1988. 31p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005514/JAW.

The purpose of this report is to summarize the management improvements by DOE. The improvements are: (1) financial management which includes consolidation of DOE payroll/personnel systems, departmental integrated standardized core accounting system, and reduction in DOE organizational elements and federal staffing; (2) procurement; (3) productivity which includes contractor productivity initiatives; (4) information management and telecommunications; (5) administrative/management processes, including planning process for multiprogram general purpose in ER funds projects; and (6) management of departmental operations including marketing uranium enrichment services, plutonium utilization improvement project, initiation of agency-wide strategy, and consolidating contractors. (TC)

9902 Mathematics And Computers

REFER ALSO TO CITATION(S) 11022, 11431, 11616, 11865, 12113, 12116, 12136

12464 **(AD-A—198731/2/XAB) Some aspects of parallel implementation of the finite-element method on message-passing architectures.** Babuska, I.; Elman, H.C. (Maryland Univ., College Park (USA). Inst. for Advanced Computer Studies). May 1988. 31p. (UNIAC-TR—88-35). NTIS, PC A03/MF A01.

Discussed are some aspects of implementing the finite-element method on parallel computers with local memory and message passing. In particular, the costs of using high-order and low-order elements, and of direct and iterative solvers are compared for solving the linear systems that occur. The author's model of parallel computation is a two-dimensional grid of processors chosen to be similar in shape to the underlying grid. The main conclusions are that sparse direct solvers generalize naturally to methods based on high order elements, and that direct solvers are adequate for two-dimensional problems, especially for multiple load vectors. High-order methods are shown to achieve higher accuracy at less cost on some typical model problems.

12465 **(AD-A—199350/0/XAB) Fault-model development for fault-tolerant VLSI design. Final technical report, May 1986-May 1987.** Hartmann, C.R.; Lala, P.K.; Ali, A.M.; Visweswaran, G.S.; Ganguly, S. (Philadelphia Dept. of Public Property, PA (USA)). May 1988. 135p. NTIS, PC A07/MF A01.

Fault models provide systematic and precise representations of physical defects in microcircuits in a form suitable for simulation and test generation. The current difficulty in testing VLSI circuits can be attributed to the tremendous increase in design complexity and the inappropriateness of traditional stuck-at fault models. This report develops fault models for three different types of common defects that are not accurately represented by the stuck-at fault model. The faults examined in this report are: bridging faults, transistor stuck-open faults, and transient faults caused by alpha-particle radiation. A generalized fault model could not be developed for the three fault types. However, microcircuit behavior and fault-detection strategies are described for the bridging, transistor stuck-open, and transient (alpha-particle strike) faults. The results of this study can be applied to the simulation and analysis of faults in fault-tolerant VLSI circuits.

12466 **(AD-A—199987/9/XAB) Survey of parallel computing. Final technical report, June 1987-February 1988.** Miller, S.E. (Amherst Systems, Inc., Buffalo, NY (USA)). Jul 1988. 200p. NTIS, PC A09/MF A01.

This report summarizes the research accomplished under a Small Business Innovation Research (SBIR) Phase I contract F30602-87-C-0082. Until recently, software-engineering technology has focused on the use of conventional von Neumann computer architectures. Current computer systems feature continually increasing computational resource requirements which have become unfeasible or unrealizable using conventional von Neumann techniques. Non-von Neumann architectures featuring multiple-processing elements offer solutions that achieve the application requirement. However, software-engineering technology remains oriented towards von Neumann methodologies. This, coupled with the applications-specific nature of non-von Neumann architectures, has resulted in a fragmented software-engineering environment. This effort provided a very thorough view of many of the software-engineering problems that are currently associated with the utilization of non-von Neumann computers. The results of this study support current and future applications programs by providing sound rules to architecture selection and system and software life-cycle definition.

12467 **(AD-A—199993/7/XAB) Optical acquisition, image, and data compression. Final report, June 1987-July 1988.** Eichmann, G. (City Univ. of New York, NY (USA). Dept. of Electrical Engineering). 30 Jul 1988. 100p. (CCEE—447222-3). NTIS, PC A05/MF A01.

A new conditional symbolic substitution rule for modified signed-digit arithmetic computation is introduced. Using this substitution rule, the numbers to be added or subtracted are first replaced by a pair of new equivalent strings, which in a second step are then subject to another substitution to generate both the addition or substitution result and its complement. For an optical implementation, a holographic content-addressable memory is used. Correspondingly, the input encoding, the logic reduction, and the optical-processing techniques are described. An optical isochronous array processing method is proposed. An optical isochronous array-processor (OIAP) is a local regularly interconnected processing network that employs an array of identical processing elements. In an OIAP, incoming, isochronous data are parallel processed in a fashion much like a propagating electromagnetic wave front. For the various applications, the OIAP processing elements and their interconnections can be different. In this paper, various all-optical OIAP elements are considered. Applications ranging from optical binary number multiplication preprocessing to optical matrix algebra as well as to optical residue arithmetic are presented. (KR)

12468 (AGARD-LS—158, pp 17) **High speed parallel processing networks for advanced architectures.** Morgan, D.R. Jun 1988. NTIS, PC A08/MF A01. (CONF-8806296—).

From Computing systems configuration for highly integrated guidance and control systems; Bourges, France (20 Jun 1988).

Many force multiplier improvements in vehicle control, situation awareness and crew decision aiding will be made possible if affordable, flyable supercomputers and associated software can be developed for next-generation military aircraft. New functional architectures will emerge because dramatic improvements in processing speed can be implemented through tightly coupled networks. Unconstrained system architectures can be developed where the system designer will have the capability to fuse together needed logical functions irrespective of previous boundaries. In addition, increased local processing (e.g., smart sensors) will be made possible to improve threat and target classification. Robust use of real-time artificial intelligence at both local, functional and system levels will be achievable, along with inprovements in fault tolerance and system diagnostics.

12469 **(ANL—88-46) Vectorizing compilers: A test suite and results.** Callahan, D.; Dongarra, J.; Levine, D. (Argonne National Lab., IL (USA)). Nov 1988. Contract W-31109-ENG-38. 38p. NTIS, PC A03 - OSTI. Order Number DE89005376/JAW.

The report describes a collection of 100 Fortran loops used to test the effectiveness of an automatic vectorizing compiler. We present the results of compiling these loops using commercially available, vectorizing Fortran compilers on a variety of supercomputers, minisupercomputers, and mainframes. 4 refs., 9 tabs.

12470 **(CONF-8802127—1) EMMPDL: An Electron Microscopy and Microanalysis Public Domain Library.** Zaluzec, N.J. (Argonne National Lab., IL (USA)). 1988. Contract W-31109-ENG-38. 9p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89003884/JAW.

From Workshop on electron-beam induced spectroscopies at very high spatial resolution; Aussois, France (29 Feb 1988).

The Electron Microscopy and Microanalysis Public Domain Library is a collection of computer software, information and data specifically directed toward microstructural characterization. Accessible by conventional telecommunications protocols, as well as via BITNET electronic mail, it is available free of charge to all members of the scientific community interested in submitting or retrieving software, information and data for the purpose of expanding scientific and educational knowledge in the application of microscopy and microanalysis into whichever fields of science they may be found to be applicable. 2 refs., 2 tabs.

12471 **(DOE/ER/13782—1) [The use of optical flow fields in establishing stereo correspondence]: Progress report, September 1987--April 1988.** (Maryland Univ., College Park (USA). Dept. of Mechanical Engineering). 1988. Contract FG05-87ER13782. 7p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005325/JAW.

During the period from September 1987 to April 1988 extensive theoretical work and preliminary experimental work have been performed to analyze stereo image sequences in which there is relative translational motion between the cameras and the objects in the field of view. In this theory, the velocities and positions of features in the image sequences are used as input to determine the relative translational velocities, the correspondence between features in the left and right images, and, from this correspondence, the range to the features in question. If the features in each image are points, the total velocity of each feature is easily measured by a number of existing techniques. If the features are contours only the component of the velocity in the direction normal to the contour can be measured. However, if in a small region of an image, the flow originates from moving contours on a single surface and the contours are sufficiently curved, then the velocities from the normal flow can be fitted statistically to a second order polynomial and the full optical flow can be obtained. In the present work, separate theories have been developed that start with the full optical flow and the normal flow and then compute the translational velocity and the range to the features. In the interest of brevity, only a summary of the method starting with the full optical flow is presented in this paper. 3 figs., 2 tabs.

12472 **(DOE/NE/37968—2) A parallel environment for structural analysis of range imagery.** Perez, A.; Abidi, M.A.; Gonzalez, R.C. (Tennessee Univ., Knoxville (USA). Dept. of Electrical and Computer Engineering). 1988. Contract FG02-86NE37968. 9p. (CONF-8804230—1). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005015/JAW.

From Digital and optical shape representation and pattern recognition; Orlando, FL, United States (4 Apr 1988).

Rigid objects can be modeled by quadric or planar polyhedra. This representation allows low-level data driven algorithms to determine the identity and pose of an object. Before an object can be matched with an internal model, however, its image must be first segmented into basic components, such as smooth patches. This paper describes a low-level parallel range data analysis system that uses input range data to characterize the underlying scene in terms of the visible surfaces, using simple, invariant features to generate a view independent description of the scene. The central components of the system are a parallel segmenter and a parallel surface fitter. The segmentation algorithms are based on the estimation of surface curvatures. Surface fitting allows for pose estimation and recognition of objects in range scenes. Mathematically, surface fitting can be formulated as an overdetermined linear system which can be solved in the least-square sense. Because of numerical stability and ease of implementation, the QR-factorization using the Givens transformation is suited for the parallel solution of overdetermined systems. We discuss the implementation of the range analysis system on a distributed-memory hypercube parallel computer. 18 refs., 7 figs.

12473 **(IAEA-R—4478-F) Software for data reduction. Final report for the period July 1986 - July 1987.** Teeyasoontranont, V. (Chiang Mai Univ. (Thailand)). (International Atomic Energy Agency, Vienna (Austria)). Oct 1987. 36p. (CPHY-FNRF—8/87). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704108/JAW.

The known mathematical technique of polynomial fitting to a set of experimental points was employed to develop a computer programme for the P/OS operating system, for the DEC Professional series of personal computers. The programme calculated the coefficients of a polynomial fit for a degree of up to ten, to a set of a maximum of a hundred measured points. It has a plotting routine to display the experimental values and the polynomial fit. A dependent variable can be calculated from the value of the input. The procedure was tested on a number of sets of experimental values, and found to give a satisfactory fit. 1 fig.

12474 **(Juel-Spez—457) Graphical editor for the presentation of technical components and their states at the COSY accelerator ring.** Strojek, J. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Projektleitung COSY). Jul 1988. 98p. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88756382/JAW.

The graphical editor is written in the Language C and the command 'bild' calls it. The presentation of technical components at the COSY accelerator ring was realized by presentations which are offered by the program RB. These pictograms can only be loaded. The states of these components are realized by push-button editors from the Xr library. These buttons can be newly generated or loaded. By the graphical operations for instance connections or cables can be presented. An editor must perform functions by which such objects can be influenced. This is erasing or moving these objects. In the submenus for the pictograms, buttons, and in the submenu 'Zeichnen' corresponding items are implemented. Single lines or a line from a line chain can be rotated. In the graphical operations line chains, rectangles, circles, and circular arcs can be filled with the foreground color. In the graphical editor also for the foreground respectively background color one from eight different colors can be chosen. These colors are used by all following functions. These colors are also taken for the buttons, which are however not used permanently, but can be changed locally.

12475 **(N—89-10063) Proceedings of 1987 Goddard conference on space applications of artificial intelligence (AI) and robotics.** Stolarik, E.G.; Littlefield, R.G.; Beyer, D.S. (National Aeronautics and Space Administration, Greenbelt, MD (USA). Goddard Space Flight Center). 1987. 718p. (NASA-TM—89663; NAS—1.15:89663; CONF-870591—). NTIS, PC A99/MF E03.

From Goddard conference on space applications of artificial intelligence and robotics; Greenbelt, MD, USA (13 May 1987).

Topics addressed include: planning/scheduling expert systems; fault isolation/diagnosis expert systems; data processing/analysis expert systems; expert system tools/techniques; and robotics.

12476 (N—89-10063, pp 19) **Dynamic task allocation for a man-machine symbiotic system.** Parker, L.E.; Pin, F.G. 1987. NTIS, PC A99/MF E03. (NASA-TM—89663; NAS—1.15:89663; CONF-870591—).

From Goddard conference on space applications of artificial intelligence and robotics; Greenbelt, MD, USA (13 May 1987).

This report presents a methodological approach to the dynamic allocation of tasks in a man-machine symbiotic system in the context of dexterous manipulation and teleoperation. This report addresses a symbiotic system containing two symbiotic partners which work toward controlling a single manipulator arm for the execution of a series of sequential manipulation tasks. It is proposed that an automated task allocator use knowledge about the constraints/criteria of the problem, the available resources, the tasks to be performed, and the environment to dynamically allocate task recommendations for the man and the machine. The presentation of the methodology includes discussions concerning the interaction of the knowledge areas, the flow of control, the necessary communication links, and the replanning of the task allocation. Examples of task allocation are presented to illustrate the results of this methodolgy.

12477 (ORNL/DSRD—11, pp 3-12) **Case grammar interpretation and the portability of natural language interfaces.** Haas, S.W.; Metzler, P. (Univ. of Pittsburgh, PA (USA)). Jul 1988. NTIS, PC A 07. Order Number DE89001300/JAW. (CONF-881090—).

From 3. international symposium on methodologies for intelligent systems; Charlotte, NC, USA (12 Oct 1988).

The theoretical and applied implications of a flexible approach to the development of case grammar based natural language interfaces are discussed. Case grammar has been used extensively in the development of natural language interfaces, in large part because it is a very useful way to organize the sources of knowledge required to produce a semantic analysis of an input. However, there has been little agreement over what precisely the different cases ought to be, or exactly where the semantic boundaries between the different cases ought to be drawn. This is troubling from two points of view. From a theoretical perspective one might expect more convergence in dealing with such a useful and intuitively appealing idea. From an applied perspective, the problem is that an interface built with one system of cases is often difficult to port to another domain. The approach described here deals with both of these issues. A case hierarchy is developed as the basis for a procedure of domain analysis. This provides a way of systematizing the process of analyzing the case structure developed for a particular domain, and determining the ways in which it would have to be altered for a new one.

12478 (ORNL/DSRD—11, pp 13-22) **ATN-based intelligent interface to an assistance system.** Neelakandan, H.; Biswas, G.; Matthews, M.M. (Cognitive Systems, Inc., New Haven, CT (USA)). Jul 1988. NTIS, PC A 07. Order Number DE89001300/JAW. (CONF-881090—).

From 3. international symposium on methodologies for intelligent systems; Charlotte, NC, USA (12 Oct 1988).

In this paper, the authors discuss the natural language interface to USCSH, an active intelligent assistance system for users of the Unix operating system. The intelligent assistance component of USCSH is capable of responding to user queries posed in natural language. An ATN-based natural language interface has been implemented for this purpose. This paper demonstrates how the ATN framework can be used to embed domain-specific semantic informa-

tion into the parsing process without sacrificing the generality of the parser. The advantage of incorporating semantic processing in the syntactic analysis phase is that it makes the subsequent processing of queries more efficient. They also show the actions attached to the arcs of the ATN can be generalized to incorporate the ability to examine conditions, make decisions and execute entire procedures. Finally, this research presents techniques to show that the ATN can be used for parsing both grammatical and ungrammatical input, even though it has traditionally been employed as a syntax-oriented machine. The ATN can thus be seen to provide a unified representation for both syntactic and semantic processing of natural language, and this conforms to the human language understanding process.

12479 (ORNL/DSRD—11, pp 23-34) **Gestalt approach for artificial vision.** Datta, A.K. (Indian Statistical Institute, Calcutta). Jul 1988. NTIS, PC A 07. Order Number DE89001300/JAW. (CONF-881090—).

From 3. international symposium on methodologies for intelligent systems; Charlotte, NC, USA (12 Oct 1988).

The paper presents a scheme for development of a computer vision input for Fifth Generation Systems Project in the Indian context. The system uses psychoperceptual phenomena for the knowledge base with Association of Expert Subsystem approach. Some relevant psychoperceptual phenomena is cited to establish the need to integrate these into the vision system.

12480 (ORNL/DSRD—11, pp 37-46) **Retargetable rule generation for expert systems.** Krovvidy, S.; Wee, W.G. (Univ. of Cincinnati, OH (USA)). Jul 1988. NTIS, PC A 07. Order Number DE89001300/JAW. (CONF-881090—).

From 3. international symposium on methodologies for intelligent systems; Charlotte, NC, USA (12 Oct 1988).

Knowledge acquisition has been identified as a key bottleneck in the development of expert systems. This perception has stimulated the investigation of machine learning methods as a means of explicating knowledge. In this paper, the authors present a generalized learning system that develops production rules for different expert systems. A scheme is presented to construct an intermediate representation for the knowledge rules. They provide a structured format for the knowledge base using context free grammar. They develop an algorithm to generate the rules for the target system using the above grammar. This system will also be helpful to transfer the knowledge base between different expert systems shells.

12481 (ORNL/DSRD—11, pp 47-56) **Generating evaluation theorems for functional programming languages.** Latch, D.M.; Sigal, R. (North Carolina State Univ., Raleigh (USA)). Jul 1988. NTIS, PC A 07. Order Number DE89001300/JAW. (CONF-881090—).

From 3. international symposium on methodologies for intelligent systems; Charlotte, NC, USA (12 Oct 1988).

A program analysis system is presented for a class of functional programming languages. First, rather than simply analyzing programs with respect to a given semantics, the authors begin by verifying the operational semantics of the language. The second form of generality pertains to the nature of the operational semantics that can be processed. There are two phases in this system. The output of the first phase, in the form of a set of inductively proved theorems about the underlying computations that implement the primitive functions and functional forms (henceforth, the primitives) of the language, serve in the second stage as a basis of an analysis of programs defined from the primitives. The second phase generates evaluation theorems about the size and structure of all possible computations of a given program. Note that this information is generated by proving theorems, rather than gathering statistics at runtime.

12482 (ORNL/DSRD—11, pp 59-76) **Obligation and outlay forecasting system.** Emrich, M.L.; Hardee, H.K.; Jairam, B.N.; Morris, J.D.; Jones, K.A. (Center for Intelligent Systems, Oak Ridge, TN (USA)). Jul 1988. NTIS, PC A 07. Order Number DE89001300/JAW. (CONF-881090—).

From 3. international symposium on methodologies for intelligent systems; Charlotte, NC, USA (12 Oct 1988).

The Office of the Director of the Budget is responsible for pricing Air Force programs. Throughout the year, budget analysts are required to prepare three cost exercises: the Program Objective Memorandum (POM), the Budget Estimate Submission (BES), and the President's Budget (PB). During budget planning and execution, analysts must make decisions regarding funding obligations and outlays. Analysis and modification of projected obligations and outlays require the use of operational and procedural heuristics. The problem-solving steps followed by analysts are being used to develop a prototype. Information regarding the prototype's structure and tool used for development is presented.

12483 (ORNL/DSRD—11, pp 77-88) **Validating queries in prolog-based databases.** Demo, B. (Universita' di Torino (Italy)). Jul 1988. NTIS, PC A 07. Order Number DE89001300/JAW. (CONF-881090—).

From 3. international symposium on methodologies for intelligent systems; Charlotte, NC, USA (12 Oct 1988).

Integrity constraints are probably one of the aspects where deductive database systems are expected to be more original compared to conventional systems. Here the authors address, in a logic programming environment, the problem of using integrity constraints at query time, in order to validate the query, i.e., to check if the query is inconsistent, thus discovering that the answer set is empty without scanning facts in the external database. The major concern of their approach is to exploit Prolog mechanisms for finding out the unsatisfiability of a set clauses avoiding as much as possible to build on top of the Prolog basic system. In the present version, the query validation process applies to queries not involving recursively defined relations.

12484 (ORNL/DSRD—11, pp 89-98) **Development of a knowledge base using an object representation and transformational approach for improving software productivity.** Diaz-Herrera, J.L.; Rine, D.C. (George Mason Univ., Fairfax, VA (USA)). Jul 1988. NTIS, PC A 07. Order Number DE89001300/JAW. (CONF-881090—).

From 3. international symposium on methodologies for intelligent systems; Charlotte, NC, USA (12 Oct 1988).

In this paper issues are presented about Expert Data Base Systems (EDBSs) specific to a particular domain of expertise, namely software engineering (SE), supporting the basic problem of replicating and expanding expertise in an Object-Oriented Software Design Environment. While general software engineering principles and objectives are the same for any software problem, the specific set of techniques and tools will probably vary with the characteristics of a specific problem area. Herein, an EDBS is a knowledge base system (KBS) which contains information derived from some area of expertise in SE; and it intended for use as a possible replacement of an expert doing comparable tasks, or making comparable decisions, in such an area.

12485 (ORNL/DSRD—11, pp 99-108) **Incoherence of knowledge based rules expert systems.** Pipard, E. (Universite Paris-Sud (France)). Jul 1988. NTIS, PC A 07. Order Number DE89001300/JAW. (CONF-881090—).

From 3. international symposium on methodologies for intelligent systems; Charlotte, NC, USA (12 Oct 1988).

This article describes software capable of detecting incoherence of rule based expert systems independently of the initial fact bases. The rule bases considered here are expressed in the syntax of the expert system generator MORSE. In order to avoid calculation saturation, production rules are broken down into sets called concepts. In this way a concept represents a maximal set of simultaneously fireable rules.

12486 (ORNL/DSRD—11, pp 111-121) **Unified formalism for knowledge representation.** Bittencourt, G. (LIFIA - INPG, Grenoble (France)). Jul 1988. NTIS, PC A 07. Order Number DE89001300/JAW. (CONF-881090—).

From 3. international symposium on methodologies for intelligent systems; Charlotte, NC, USA (12 Oct 1988).

A formal framework for the semantic description of knowledge representation methods and a system implementing it are presented. The formal framework is based on the denotational semantics approach and proposes a graph space as an abstract model for

the knowledge representation methods. Four different methods are described in this framework: frames, semantic nets, production systems and first order logic. A system allowing the automatic interpretation and execution of these descriptions has been developed and is presented. The system is based on a formalism that gives each mathematical construction in the abstract value space an operational equivalent. The resulting system is intended to be used as an interactive tool for the specification and implementation of knowledge-based systems.

12487 (ORNL/DSRD—11, pp 123-134) **COSMO a system for describing compound structures and causal reasoning.** Pirri, F. (Universita' di Roma (Italy)). Jul 1988. NTIS, PC A 07. Order Number DE89001300/JAW. (CONF-881090—).

From 3. international symposium on methodologies for intelligent systems; Charlotte, NC, USA (12 Oct 1988).

The authors present here an interactive system for describing Compound Structures. Their objective is to stress, in the way of an object-oriented data abstraction, the concept of abstract structure: that is, the independence of the structure versus the mechanism that is built on it for simulation and/or diagnostic purposes. They then propose, Constraint Equations as a concise declarative language for expressing inter-relational constraints in Compound Structure schema.

12488 **(ORNL/TM—10881) Performance of a second generation hypercube.** Dunigan, T.H. (Oak Ridge National Lab., TN (USA)). Nov 1988. Contract AC05-84OR21400. 22p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005674/JAW.

The performance of four commercially available hypercube parallel processors is analyzed. Computation and communication performance for a number of low-level benchmarks are presented for the Ametek S14 hypercube, the Intel iPSC/1 hypercube, the Ncube hypercube, and the second generation Intel iPSC/2 hypercube. 13 refs., 8 figs., 12 tabs.

12489 **(ORNL/TM—10937) A partitioning strategy for parallel sparse Cholesky factorization.** Geist, G.A.; Ng, E. (Oak Ridge National Lab., TN (USA)). Nov 1988. Contract AC05-84OR21400. 29p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005690/JAW.

This paper presents a solution to the problem of partitioning the work for sparse matrix factorization on a multiprocessor system. The goal of this partitioning strategy is to achieve load balancing and a high degree of concurrency among the processors while reducing the amount of processor-to-processor data communication. The task assignment strategy is based on the structure of the elimination tree for a given ordering, and can be applied to arbitrarily unbalanced trees. This is important because popular fill-reducing ordering methods, such as the minimum degree algorithm, often produce unbalanced elimination trees. Results from the Intel iPSC/2 are presented for various finite-element problems using both nested dissection and minimum degree orderings 14 refs., 12 figs., 6 tabs.

12490 **(ORNL/TM—10976) Bifurcating optimization algorithms and their possible application.** Culioli, J.C.; Protopopescu, V. (Oak Ridge National Lab., TN (USA)). Nov 1988. Contract AC05-84OR21400. 37p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005692/JAW.

A new class of optimization algorithms for linear and nonlinear problems is proposed. The algorithms are based on sigmoidic updatings and can be looked upon as nonlinear multidimensional maps. The bifurcation and chaotic regimes of these maps are analyzed and their possible applications in optimization problems are indicated. 13 refs., 18 figs.

12491 **(ORNL/TM—10998) A bibliography on parallel and vector numerical algorithms.** Ortega, J.M.; Voigt, R.G.; Romine, C.H. (Oak Ridge National Lab., TN (USA)). Jan 1989. Contract AC05-84OR21400. 94p. NTIS, PC A05/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005693/JAW.

This technical report contains a bibliography of the current and past research papers dealing with numerical algorithms on both parallel and vector computers. 2004 refs.

12492 **(SAND—88-0540) Simple 2-D navigation for wheeled vehicles.** Klarer, P.R. (Sandia National Labs., Albuquerque, NM (USA)). Apr 1988. Contract AC04-76DP00789. 21p. (CONF-880689—1). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE88008963/JAW.

From 15. AUVS annual technical symposium; [illegible]go, CA, USA (6 Jun 1988).

This paper describes a simple algorithm to perform navigation in a two-dimensional world model. The algorithm utilizes a simple geometric approach which is first applied to a bicycle. The equations are then expanded to apply to 3- and 4-wheeled vehicles with "conventional" steering mechanisms (such as the Ackerman steering geometry in the 4-wheeled case). Calculations for omnidirectional robots which utilize differential odometry and differential drive are described as well. Practical considerations and sources of error are discussed, as are possible extensions of this method to a three-dimensional world model. 5 refs., 8 figs.

12493 **(SAND—88-2636C) Robust shared secret schemes or "how to be sure you have the right answer even though you don't know the question".** Simmons, G.J. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 34p. (CONF-8809193—1). NTIS, PC A03/MF A01 - OSTI. Order Number DE89003397/JAW.

From 18. annual conference on numerical mathematics and computing; Winnipeg, Canada (29 Sep 1988).

A means for constructing a large family of shared secret schemes which can realize concurrence schemes of almost arbitrary complexity was introduced. These constructions depend on a hierarchy of subschemes defined for specified subsets of the participants in which the output of lower-level schemes becomes the input to higher-level schemes, etc. We show that constructions of this type can always be realized such that each participant need only keep secret on share of information, although he may have to insure the integrity, but not the secrecy, of much more. Since we measure the private information by the secret component, this is equivalent to saying that there is not redundant information in the individual private pieces of information. A general "proof of correctness" protocol is described in which one or more pieces of private information, over and above what is needed to realize the specified concurrence, was input and checked for consistency with the other inputs. This protocol provides at least as high a level of confidence in the correctness of the recovered information as one can have in the security of the scheme. Finally, an optimal procedure to recover from erroneous inputs is described which halts as soon as a certifiably correct answer is obtained. 46 refs., 16 figs.

12494 **(SAND—88-2714) The performance of asynchronous algorithms on hypercubes.** Womble, D.E. (Sandia National Labs., Albuquerque, NM (USA)). Dec 1988. Contract AC04-76DP00789. 22p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89005503/JAW.

Many asynchronous algorithms have been developed for parallel computers. Most implementations of asynchronous algorithms, however, have been for shared memory machines. In this paper, we study the implementation and performance of some common asynchronous algorithms on the NCUBE/ten, a 1024 node hypercube. In addition, we summarize existing theoretical work and discuss some classes of algorithms that can be made asynchronous and some that cannot. 16 refs., 3 figs.

12495 **(SAND—88-2727) DOEDEF Software System, Version 2.2: Operational instructions.** Meirans, L. (Sandia National Labs., Albuquerque, NM (USA)). Nov 1988. Contract AC04-76DP00789. 271p. NTIS, PC A12/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004455/JAW.

The DOEDEF (Department of Energy Data Exchange Format) Software System is a collection of software routines written to facilitate the manipulation of IGES (Initial Graphics Exchange Specification) data. Typically, the IGES data has been pro-

duced by the IGES processors for a Computer-Aided Design (CAD) system, and the data manipulations are user-defined "flavoring" operations. The DOEDEF Software System is used in conjunction with the RIM (Relational Information Management) DBMS from Boeing Computer Services (Version 7, UD18 or higher). The three major pieces of the software system are: Parser, reads an ASCII IGES file and converts it to the RIM database equivalent; Kernel, provides the user with IGES-oriented interface routines to the database; and Filewriter, writes the RIM database to an IGES file.

12496 **(SAND—88-2971) ASSISTANT: A hybrid expert system for assisting seismologists in the analysis of seismic array performance.** Hiebert-Dodd, K.L.; Walck, M.C.; Elbring, G.J. (Sandia National Labs., Albuquerque, NM (USA)). Dec 1988. Contract AC04-76DP00789. 26p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89005302/JAW.

This report describes an expert system, ASSISTANT, that is written in Lisp and runs on a Symbolics 3610 but invokes numerical codes written in FORTRAN on a MicroVAX II. It is the result of a project whose purpose was to investigate and develop an expert system that can reduce the amount of the human expert's time required to process sensor data and that can be used to determine a more optimal sensor system. The focus was on the concept of a hybrid expert system. An expert system is a well known technique from the field of artificial intelligence that tries to capture human expertise in computer software. The term hybrid is used to imply the coupling of this technique to direct the more traditional numerical techniques of signal analysis. An exemplary task, the evaluation of seismic array data to determine optimal array configurations for nuclear test ban treaty applications, was selected in order to develop this concept. The array configurations analysis proved to be a very appropriate application and has lead to a powerful concept for an expert system that manages and assists in the parametric analysis of numerical databases. 11 refs., 5 figs.

12497 **(UCRL—98958-Rev.1) Integrating UNIX terminal services into a distributed operating system.** Lee, G.M. (Lawrence Livermore National Lab., CA (USA)). 28 Nov 1988. Contract W-7405-ENG-48. 16p. (CONF-890250—1-Rev.1). NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004788/JAW.

From USENIX '89 winter conference; San Diego, CA, USA (1 Feb 1989).

One solution to the problem of integrating the terminal services of a UNIX host into a distributed operating system is to implement the distributed operating system as a guest layer in UNIX and then to add a software interface that runs on the host and transiates between the terminal services of the host and the distributed operating system. Such an interface was implemented at the Lawrence Livermore National Laboratory. Design issues and decisions that preceded software development are discussed, followed by details of software operation. Development experiences that would be applicable to a similar effort are described. 20 refs., 8 figs.

12498 **(UCRL—100010) Message handling systems: Interoperability problems between 1984 and 1988 X.400.** Kehres, T. (Lawrence Livermore National Lab., CA (USA)). 1988. Contract W-7405-ENG-48. 10p. (CONF-8810265—1). NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE89004044/JAW.

From Working conference on message handling systems; Costa Mesa, AZ, USA (10 Oct 1988).

This is a position/discussion paper for the IFIP WG 6.5 Workshop on MHS Gateways. When the 1988 CCITT X.400 Recommendations are published, they will represent a major extension from those that were presented in 1984. Some of these extensions cover such areas as MHS use of the Directory, a new format for O/R Names, loop detection and suppression, postal delivery, distribution lists and secure messaging. In addition, the Message Store (MS) has been formally defined. Both the MTS Transfer Protocol (P1) as well as the Interpersonal Messaging Protocol (P2) have also undergone considerable changes. A new protocol, the MS Access Protocol (P7) has been introduced for User Agent (UA) to MS interaction. Unfortunately, P1 (88) and P2 (88) are not completely compatible with the protocols specified in the 1984 recommendations. Along with the new capabilities present in the 1988 standards are recommendations on how 1984 and 1988 based implementations are to interwork. Although these recommendations are adequate for current 1984 users, they require a significant reduction in the services available to 1988 users any time they have messages routed through a 1984 system. It is the intent of this paper to try to identify some of the issues in this area, and to suggest possible ways where these interworking problems can be reduced. 11 refs.

12499 **Gigaflop speed algorithm for the direct solution of large block-tridiagonal systems in 3-D physics applications.** Anderson, D.V.; Fry, A.R.; Gruber, R.; Roy, A. (National Magnetic Fusion Energy Computer Center, Lawrence Livermore National Laboratory, Livermore, California 94550). *Computers in Physics;* 3: No. 2, 33-41(Mar 1989).

In the discretization of the 3-D partial differential equations of many physics problems, it is found that the resultant system of linear equations can be represented by a block tridiagonal matrix. Depending on the substructure of the blocks, one can devise many algorithms for the solution of these systems. For plasma physics problems of interest to the authors, several interesting matrix problems arise that should be useful in other applications as well. In one case, where the blocks are dense, it was found that by using a multitasked cyclic reduction procedure, it was possible to reach gigaflop rates on a Cray-2 for the direct solve of these large linear systems. The recently built code PAMS (parallelized matrix solver) embodies this technique and uses fast vendor-supplied routines and obtains this good performance. Manipulations within the blocks are done by these highly optimized linear algebra subroutines that exploit vectorization as well as overlap of the functional units within each CPU. In unitasking mode, speeds well above 340 Mflops have been measured. The cyclic reduction method multitasks quite well with overlap factors in the range of three to four. In multitasking mode, average speeds of 1.1 gigaflops have been measured for the entire PAMS algorithm. In addition to the presentation of the PAMS algorithm, it is shown how related systems having banded blocks may be treated efficiently by multitasked cyclic reduction in the Cray-2 multiprocessor environment. The PAMS method is intended for multiprocessors and would not be a method of choice on a uniprocessor. Furthermore, this method's advantage was found to be critically dependent on the hardware, software, and charging algorithm installed on any given multiprocessor system.

12500 **Superconducting applications.** Wienke, B.R.; Buzbee, B.L. (Applied Theoretical Physics Division of the Los Alamos National Laboratory). *Physics Teacher;* 27: No. 1, 10-21(Jan 1989).

A number of uses for present day supercomputers are considered. Among the applications disscused are aircraft design, quantum chromodynamics, particle transport, hydrodynamics, and plasma plysics. (AIP)

9903 Information Handling

REFER ALSO TO CITATION(S) 11593

12501 **(AD-A—199093/6/XAB) Structuring framework for distributed operating systems. Technical report.** Nehmer, J. (Maryland Univ., College Park (USA). Dept. of Computer Science). Jul 1988. 53p. (CS-TR—2079). NTIS, PC A04/MF A01.

This technical report is an attempt to survey the organization principles for distributed systems in a systematic and concise manner. Starting with a comprehensive set of terms covering the area of distributed computing, a classification scheme for distributed operating systems is developed. Based on this classification scheme several communication models are surveyed. Client-server models as an attractive structuring means for distributed operating systems are discussed in greater depth. The report concludes by elaborating the nature of cooperation as an unique underlying principle to organize the work in distributed systems. Distributed computing -as opposed to centralized computing - appears as an attractive alternative to configure a computing system and to organize its work. It receives its potential power from a characteristic fundamental to the structure of any distributed system: its conceptually unlimited extensibility in terms of processing nodes and storage ca-

pacity. This property gives rise to the hope that some day one will be able to build distributed systems which - in terms of processing power and reliability - will exceed by far the most-powerful centralized systems ever built.

9904 Law

REFER ALSO TO CITATION(S) 10860

12502 (ACUNS—88, pp 368-373) **The Beaufort Sea boundary dispute (Canada/Alaska): a discussion.** Murphy, P. (Carleton Univ., Ottawa, Ont.). 1988. Association of Canadian Universities for Northern Studies, 130 Albert Street, Ottawa, Ont., Canada K1P 5G4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN. (CONF-8511343—; MICROLOG—88-02606).

From National student conference on northern studies; Ottawa, Canada (18 Nov 1985).

The Beaufort Sea boundary dispute is an example of an international maritime boundary dispute between Canada and the USA. Both claims forwarded by Canada and the USA are based upon different interpretations of the emerging Law of the Seas (LOS) and international case law. The U.S. boundary claim is based upon an equidistant measurement from the Canada-U.S. Beaufort Sea coast. The Canadian boundary claim is based on the extension of the Alaska/Yukon land boundary. The two overlapping boundaries create a pie-shaped zone, or ocean-space, of conflicting jurisdictions in the Beaufort Sea coastal region. As a result, a high degree of uncertainty exists. State sovereignty, economic potential, and prestige are some of the factors that impel the two coastal states of the Beaufort Sea region to press their respective boundary claims. 54 refs., 1 fig.